METHANE-FUELED VEHICLE RD&D

HEARING

BEFORE THE

SUBCOMMITTEE ON TRANSPORTATION,
AVIATION AND MATERIALS

OF THE

COMMITTEE ON
SCIENCE AND TECHNOLOGY
HOUSE OF REPRESENTATIVES

NINETY-EIGHTH CONGRESS

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METHANE-FUELED VEHICLE RD&D

THURSDAY, APRIL 26, 1984

House of Representatives,
Committee on Science and Technology,
Subcommittee on Transportation, Aviation and Materials,
Washington, DC.

The subcommittee met, pursuant to notice, at 9:38 a.m., in room 2325, Rayburn House Office Building, Hon. Dan Glickman (chairman of the subcommittee) presiding.

Present: Representatives Glickman, Harkin, and McCandless.

Mr. **Glickman**. Good morning.

Today the subcommittee will consider the Department of Energy's implementation of Public Law 96–512, the Methane Transportation Research, Development and Demonstration Act of 1980. We will also consider modifications in this program to improve and refocus the demonstrations envisioned under this law in order to more effectively deal with some of the more pressing issues of methane fuel, such as emissions and refueling.

This law provided for advanced and accelerated research and development of methane- or natural-gas-fueled-vehicle design and related technologies, and for the facilitation and removal of barriers to the use of methane-fueled vehicles as an alternative to gasoline- or diesel-powered vehicles, where practicable.

This law also directed the Department of Energy to support private and public entities in developing and implementing more than 50 demonstration projects to gather data on the operation of methane-fueled vehicles and methane transmission, storage, and dispensing facilities, and on design and technical modifications of those vehicles and facilities.

Although the Department of Energy has implemented some of the research, the demonstrations have not been implemented. Given the extensive experience of many organizations in operating methane-fueled vehicles over the last several years, it is probably not currently necessary to implement the entire demonstration program as originally envisioned. However, the critical issues of refueling and emissions remain. In short, it may be appropriate to restructure the demonstration programs through an amendment to the act itself or by an amendment to the Department of Energy authorization bill.

The potential for petroleum conservation by the use of methane as a near-term alternative fuel continues to be significant. Of all the alternative fuels that have been discussed, natural gas shows the most potential, particularly for motor fuel. If we converted 1 million vehicles to natural gas use or methane use, we would reduce U.S. consumption of petroleum by approximately 300,000 barrels a day.

I would like to welcome the witnesses who have agreed to assist us today. I look forward to a productive and informative hearing.

Our first witness is Donna Fitzpatrick, Principal Deputy Assistant Secretary for Conservation and Renewable Energy at the Department of Energy.

It is a pleasure to have you here, and you may proceed.

I would say to you, as I do to all of our witnesses, that your entire statement will appear in the record, so you may feel free to summarize or read them as you deem appropriate.

STATEMENT OF DONNA R. FITZPATRICK, PRINCIPAL DEPUTY ASSISTANT SECRETARY, OFFICE OF CONSERVATION AND RENEWABLE ENERGY, DEPARTMENT OF ENERGY, ACCOMPANIED BY RALPH D. FLEMING, PROGRAM MANAGER FOR METHANE RESEARCH AND DEVELOPMENT, AND PAUL J. BROWN, ACTING DIRECTOR, OFFICE OF VEHICLE AND ENGINE RESEARCH AND DEVELOPMENT

Ms. **Fitzpatrick**. Thank you, Mr. Chairman.

I will summarize my statement.

Mr. Chairman and Mr. McCandless, we appreciate the——

Mr. **Glickman**. Excuse me. I didn't ask Mr. McCandless if you had any opening remarks. I apologize.

Mr. **McCandless**. Thank you, Mr. Chairman.

I was just thinking about that wheat in Kansas that we were talking about. [Laughter.]

I'm going to drop a little thought for those of you who are testifying. My experience in the field of natural gas for purposes of powering automobiles and light-duty trucks has been very negative. So if any of you have any thoughts about positive experiences, I'd be more than interested in hearing that aspect of it.

Thank you, Mr. Chairman.

Ms. **Fitzpatrick**. Thank you, Mr. Chairman.

We appreciate the honor to—the opportunity to appear before you today to discuss the Methane Transportation Research and Development and Demonstration Act and the proposed amendment to that act.

As you know, it is my responsibility to assist the Acting Assistant Secretary for Conservation and Renewable Energy in overseeing the activities of our office. My specific mandate from the Secretary is to improve the Department's programs in conservation and renewable energy within the policy framework of the national energy policy plan published in October 1983, and to be particularly conscious of the activities and interests of the Congress.

With that in mind, I would like to introduce two of the people who are helping us to improve these programs: on my right, Mr. Paul Brown, who is Acting Director of the Office of Vehicle and Engine Research and Development, and, on my left, Dr. Ralph Fleming, who is Program Manager for Gaseous Fuels Research and Development.

We will address the proposed amendment and the implementation of the act within the context of the goals and strategies set forth in the national energy policy plan. The overall goal of our National Energy Policy is to foster an adequate supply of energy at reasonable cost. The strategies for achieving this energy policy goal are, first, to minimize Federal control and involvement in energy markets while maintaining public health, and safety, and environmental quality, and, second, to promote a mixed and balanced energy resource system.

In allocating our resources toward achieving our goal, we are concentrating on applying Federal funds only where they are most effective, in sponsoring research and development where the potential payoff is high but where private industry cannot be expected to make a large investment because the return on the investment would require an exceptionally long time to be realized or because the results are difficult to predict.

The national energy policy plan provides a sound policy framework for discussing methane and the appropriate role for Government in encouraging its development as a transportation fuel.

Methane has an excellent potential as a fuel for use in spark-ignition engines. It represents an alternative fuel that is currently available in quantity. It has a substantial bulk distribution network already in place, and it requires no significant technical development to be used in today's engines.

The natural gas industry is actively promoting the sale and use of methane-vehicle-conversion equipment and refueling facilities for fleet operations. The American Gas Association has identified vehicular-fuel use as a major potential market.

The technical and nontechnical or operational aspects of using methane have been identified, but the issues involved should be addressed in different ways.

Technical aspects are best addressed in the laboratory where conditions can be controlled. This is particularly true in the case of exhaust emissions. We are studying methane emissions as part of our work in spark ignition and diesel engines.

The Department of Energy has been assisting industry by addressing a number of the technical issues, including establishing a data base for engine optimization and filling data gaps as they appear.

Areas that have been or are being investigated by the Department include optimization of engine-design parameters, compressed natural gas storage, liquid natural gas use in railroad engines, and the safey aspects of the use of methane as a transportation fuel.

We are also initiating research on use of methane in automotive diesel engines and to establish the allowable levels of contaminants in natural gas used in compressed natural gas vehicles.

The nontechnical, or operational aspects, such as inservice reliability, durability, and driver satisfaction, are important to the commercial success of methane fuel. Much of the needed operational experience is being gained today in the private sector by the 25,000 to 30,000 natural-gas-fueled vehicles which are operating around the country under a variety of applications, and in various geographic locations, and climates.

The additional fleet specified by the proposed amendment to Public Law 96-512 will add a relatively small amount of operating experience to that already being accumulated by these private fleets.

Additionally, more in-service fleet data will add little to the technology base used for design improvements. For example, exhaust emission requirements should be based on controlled laboratory tests over a specified driving cycle. Inservice emissions, on the other hand, will vary from system to system and from fleet to fleet.

To conclude, let me say that we are encouraged by the interest of this committee in the use of methane as a vehicular fuel, as we are by the positive steps being taken in the private sector to demonstrate its use. We believe that these private-sector efforts will go a long way toward providing the inservice experience needed to encourage and expand the use of methane-fueled vehicles. We believe that this is the proper function of industry, and the Government should continue to concentrate its resources on basic and applied methane research and development already being conducted or planned by the Department of Energy.

Mr. Chairman, we are pleased to have the advice that we have gotten from Congress, and in particular from this subcommittee, and we thank you for the opportunity to appear here today.

[The prepared statement of Donna Fitzpatrick follows:]

STATEMENT OF DONNA R. FITZPATRICK
PRINCIPAL DEPUTY ASSISTANT SECRETARY
OFFICE OF CONSERVATION AND RENEWABLE ENERGY
U.S. DEPARTMENT OF ENERGY

BEFORE THE

SUBCOMMITTEE ON
TRANSPORTATION, AVIATION AND MATERIALS

OF THE

COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

APRIL 26, 1984

Mr. Chairman and Members of the Subcommittee, I appreciate the opportunity to appear before you today to address the Methane Transportation Research, Development and Demonstration Act of 1980 (P. L. 96-512) and the proposed amendment to that Act. I shall address this program within the context of the goals and strategies set forth in the Fourth National Energy Policy Plan, published in October 1983. This plan provides a sound policy framework for discussing methane and the specifically appropriate role for government in encouraging its development as a substitute transportation fuel.

NATIONAL ENERGY POLICIES AND STRATEGIES

The overall goal of our national energy policy is to foster an adequate supply of energy at reasonable costs. The policy recognizes that "adequate supply" requires flexibility in the energy system, with no undue reliance on any single source of supply. The goal of "reasonable costs" suggests economic efficiency within the energy system, so that energy consumers - - individual, commercial, and industrial users alike - - are not penalized by economic rigidities introduced into the system by ill-advised governmental regulation. The strategies for achieving this energy policy goal are: (1) to minimize Federal control and involvement in energy markets while maintaining public health and safety and environmental quality; and (2) to promote a balanced and mixed energy resource system.

METHANE

Methane or natural gas has excellent potential as a transportation fuel, and its applications for fleet operations has been recognized by the private sector. P.L. 96-512 was enacted on December 12, 1980, and it authorized funding to be appropriated to the Secretary of Energy to undertake research and development (R&D) activities and conduct demonstrations of technologies for methane-powered vehicles and related facilities used in fleet and farm applications. Although no funds have been requested by the Administration or appropriated by the Congress to implement the Act, a limited R&D effort was initiated as part of existing Department programs.

The Office of Vehicle and Engine R&D (VERD), under the Assistant Secretary for Conservation and Renewable Energy, has the responsibility for work related to implementation of the Act. As required by Section 7 (a) of the Act, an assessment of the state of the art of methane vehicle technology was made during 1981 and the final report entitled "Assessment of Methane-Related Fuels for Automotive Fleet Vehicles" (DOE/CE/50179-1) was published in February 1982. The study identified three areas where additional work would be advantageous. These areas are: (1) performance, fuel economy, and emissions characterization of natural gas-fueled vehicles; (2) vehicle safety; and (3) institutional barriers. With consideration of the Act's provision that the R&D program supplement rather than supplant, duplicate, or lessen the R&D efforts of the private sector, administrative regulations were promulgated to assure that new R&D would supplement industry efforts. The final rule was issued on March 31, 1982.

PROPOSED AMENDMENT

The proposed amendment specifically addresses the vehicle fleet demonstration program outlined by Section 7 of the Act. No funds were appropriated to conduct these demonstrations, and the guidelines and initial request for proposals originally required by April 1, 1982, were deferred. The amendment reduces the scope of the demonstration program and emphasizes vehicle emissions data and refueling facilities. In reviewing the purpose of the demonstrations, a number of interrelated factors emerge. One set of factors relate to operational and institutional issues, and another is largely technical in nature. To be most effective, the technical and nontechnical factors should be addressed in different ways.

The technical aspects of using methane or natural gas as a vehicular fuel are best answered in the laboratory and through vehicle design. Laboratory control is usually needed to obtain valid data on performance and emissions that can be used to evaluate the effects of design variables or compare methane to other fuels. Such data are important and necessary in the design of original equipment engines dedicated to methane and in assessing the more common practice of retrofitting vehicles to dual fuel operation.

Operational aspects include such factors as in-service reliability, durability, driver satisfaction, and infrastructure issues. Although these factors are important to the commercial success of methane fuels, in-service experience provides little information on the technical aspects of designing better dual fuel or single fuel engines and systems. For example, exhaust emission requirements are based on controlled laboratory tests over a specified driving cycle; in-service emissions will vary from system to system and from fleet to fleet. It is important to note that the operational aspects will differ significantly between dual fuel and single fuel (optimized) systems.

There are 25,000 to 30,000 natural-gas-fueled vehicles currently operating in fleets around the United States. These fleets are operating under a variety of applications and in various geographic locations and climates. The additional fleets specified by the amendment would add little to the level of in-service and refueling experience already being accumulated by these private fleets. In-service emissions data are probably lacking since this information is of little interest to fleet operators concerned with performance, cost, reliability, etc. The most valid and usable emissions data from vehicles in the field would be obtained through periodic tests over the Environmental Protection Agency (EPA) Urban driving cycle on laboratory chassis dynamometers. An approach to obtaining these data in a manner more cost effective than the proposed program may be to have EPA arrange with the fleet operators to gain access to selected vehicles and conduct the appropriate tests. EPA has been very active in determining in-service emissions for gasoline vehicles and could carry this experience over to methane vehicles as well. Such a program could be implemented readily and provide emissions data more quickly.

Methane does offer potential benefits as a fuel for spark ignition engines, particularly when the engine is optimized for methane use. Ford Motor Company has developed a number of vehicles designed to operate on natural gas, including a number of advanced technologies (e.g., lightweight storage tanks), and data are being obtained. The Department of Energy has been assisting industry by establishing a data base for engine optimization and filling data gaps as they appear. Areas that have been or are being investigated by the Department include institutional barriers, safety, optimization of engine design parameters, compressed natural gas storage, and liquid natural gas use in railroad engines. We are also initiating projects to further investigate methane use in automotive diesel engines and to establish the allowable levels of contaminants (e.g., hydrogen sulfide, carbon dioxide, and water) in natural gas used for compressed natural gas vehicles. Emissions are being addressed as part of our experimental spark ignition and diesel engine investigations. It is generally true that carbon monoxide and reactive hydrocarbon emissions from spark ignition engines can be reduced compared to gasoline, but careful attention to design will be necessary to achieve these reductions. A complete list of past, current and planned Department of Energy projects on methane is attached.

SUMMARY

In summary, the Department of Energy believes that methane or natural gas is an excellent motor fuel for many fleet applications, and this has been recognized by the private sector. The Department has sought to assist industry in selected technical areas, but the demonstrations proposed by the Act and amendments will add little to the design data and in-service experience that are being accumulated already. In-service emissions data could be obtained in a more cost-effective manner by coupling emission tests with existing fleet operations.

This concludes my testimony. I will be happy to answer any questions at this time.

DEPARTMENT OF ENERGY METHANE PROGRAM

Summary of Activities

The Office of Vehicle and Engine R&D (VERD), under the Assistant Secretary for Conservation and Renewable Energy, has the responsibility for work related to implementation of the Methane Transportation Research, Development and Demonstration Act of 1980 (P.L. 96-512). As required by Section 7 (a) of the Act, an assessment of the state of the art of methane vehicle technology was made during 1981 and the final report was published in February 1982 as report DOE/CE/50179-1, "Assessment of Methane-Related Fuels for Automotive Fleet Vehicles." The study identified three technical areas where additional work would be advantageous. These areas were: (1) performance, fuel economy, and emission characterization of natural gas-fueled vehicles; (2) vehicle safety; and (3) institutional barriers. With consideration of the Act's provision that the R&D program supplement rather than supplant, duplicate, displace, or lessen the R&D efforts of the private sector, the VERD program was designed to supplement industry in its R&D endeavors. Of the $3.984 million Alternative Fuels Utilization Program (AFUP) budget within VERD appropriated for FY 1982, $400,300 was used to fund methane R&D. An additional $200,000 was allocated from the $1.5 million AFUP budget appropriated for FY 1983. The FY 1982, FY 1983, and FY 1984 projects for methane R&D include the following areas of study.

Activity	Status	Funding
Assessment of Institutional Barriers Inhibiting the Use of Methane (Natural Gas) Vehicles	Jack Faucett Associates, Inc., was selected as the contractor through competitive bidding. This activity was started in August 1982 and the final report was published in August 1983 as DOE/NASA/0295-1, "Assessment of Institutional Barriers to the Use of Natural Gas in Automotive Vehicle Fleets." Institutional barriers to the use of natural gas as a fuel for motor vehicle fleets were identified and assessed, and recommendations for barrier removal were then developed. Of the eight barriers identified, two were safety related and can be removed through development and implementation of national design and use standards for natural gas vehicles and refueling stations. Other barriers were associated with vehicle manufacturers' warranties, Environmental Protection Agency polices on tampering and hydrocarbon emission standards, resale prohibitions on natural gas, and updating state road use taxes to reflect equitable treatment of natural gas-fueled vehicles.	$48,400 (FY82)

Activity	Status	Funding
Assessment of Relative Hazards of Gaseous Fuels as compared with Gasoline and Diesel Fuel, and Delineation of Criteria for Safe Handling of Gaseous Fuels in the Transportation Sector	This activity was performed by the Los Alamos National Laboratory. The effort was initiated in June 1982 and completed in March 1983. The draft final report was submitted in March 1983, and the final report was published in November 1983. The report is entitled "Gaseous Fuel Safety Assessment for Light-Duty Automotive Vehicles." Compressed and liquefied natural gas (CNG and LNG) were compared to liquefied petroleum gas, gasoline, and diesel fuel on the basis of physiochemical properties and predicted behavior under several accident scenarios. The results of the analysis demonstrated dependency upon the specific scenario; gaseous fuels have increased relative risk in some cases (residential garages) but are relatively safe in others (collisions). The results do not disqualify natural gas fuels from public usage, but improved engineering technology and established safety regulations should be available to assist in risk reduction.	$100,000 (FY82)
Basic Engine Data to Determine the Potential for Improvement of Engine Fuel Efficiency with Natural Gas	Southwest Research Institute was selected as the contractor through competitive bidding. The project was started in November 1982 and Phase I was completed in July 1983. A single-cylinder research engine representative of modern light-duty automotive engine design was operated over a range of compression ratios, ignition timing settings, and air-fuel ratios. A data base of engine performance, efficiency, and emissions characteristics has been established for operation on natural gas. Phase II was initiated late in FY 1983 to investigate the effects of combustion chamber shape (wedge versus hemispherical) on engine performance and emissions. The projected completion date for Phase II is September 1984. The draft final report will be submitted to DOE in November 1984, and, publication of the report is planned for January 1985.	$90,400 (FY82) $100,000 (FY83)

Activity	Status	Funding
Research on New Storage Concepts for Compressed Natural Gas	This activity comprises the following two projects. Procurement of these projects resulted from a NASA-LeRC announcement for unsolicited proposals (AN; LeRC; 82-D; July 1982).	
	The first project is entitled "Advanced On-Board Storage Concepts for Compressed Natural Gas-Fueled Automotive Vehicles" and was performed by the Institute of Gas Technology. The period of performance was from April 1983 through December 1983. The draft final report was submitted in February 1984 and the estimated report publication date is June 1984. The experimental effort has focused first on characterizing the adsorption properties of commercially available zeolites and carbons. Advanced materials with the potential to store methane at low pressures were identified through a literature search and were subjected to methane absorption capacity testing. The materials encompass solids that utilize clathration encapsulation, and solvent liquids such as silicones and perfluoro carbons.	$88,168 (FY82)
	The contractor for the second project, which is entitled "Methane Storage on Interlayered Substrates," is Gulf Research and Development Company. The project started in June 1983 and has a duration of 12 months. The draft report will be submitted to DOE in June 1984, and publication of the report is plannned for November, 1984. The objective of this effort is to measure absorption of methane by certain interlayered clays and phosphates which are believed to have high storage capacity for the gas. These materials could lead to low pressure gas cylinders, and reduced accident hazards. Initial work has been directed toward preparation and characterization of zirconium phosphates and sorbent screening at low pressures using methane and pentane.	$83,200 (FY82)
Investigation of Liquefied Natural Gas (LNG) as a Fuel for Medium Speed Diesel Engines in Rail Applications	Southwest Research Institute was the sole source selection for this project because it possesses the only available railroad diesel test engine; furthermore, Institute personnel have the expertise to conduct the desired investigation. Vaporized (gaseous) LNG will be injected into the engine cylinders, with ignition	$125,000 (FY84)

Activity	Status	Funding
	accomplished by using secondary injection of a pilot charge of diesel fuel. Parameters to be investigated during the project include feed rates of the pilot fuel and natural gas, and injection pressure of the natural gas. Measurements will include both engine performance fuel consumption and emissions. The results of these data have broad technical relevance to many heavy duty truck and bus applications The experimental work will start September 1984. The project is scheduled for completion in May 1985, with submission of the draft final report at that time. The final report is expected to be published in September 1985.	
Evaluation of the Effect of Natural Gas Quality on Corrosion in CNG Storage Systems	This is a planned project and will be cost shared with 25% share from the New York Gas Group, Inc., 25% share from New York State Energy Research and Development Authority with the balance being funding by the Department of Energy. The Contractor will be determined through a competitive procurement. The objective of the project is to define natural gas contaminant concentration limits necessary to ensure that internal corrosion of compressed natural gas vehicle fuel tanks does not constitute a hazard over the lives of the tanks. Natural gas contaminates of principal concern are water, hydrogen sulfide, carbon dioxide, oxygen and other water-soluble sulfides. The project will be initiated in mid-summer 1984, with a project period of about one year. A final report will be published in about three months following completion of the experimental work.	$210,000 (FY84)

Mr. **Glickman**. Thank you, Donna.

Let me just ask you this question: the law as it currently reads, even though there has been no appropriation for the demonstration project, contains a rather ambitious demonstration project. Which would the Department of Energy prefer, the demonstration program as written in the law or the—or a scaled-down demonstration program as defined in a proposed amendment that I have talked about, which you have gotten a copy of?

Ms. **Fitzpatrick**. Yes, sir; the proposed amendment would have 11 fleets, a total of 11 fleets, against, I believe it was, 50 fleets in the law.

We would prefer, given only those two choices, to have the amendment, of course.

Mr. **Glickman**. But—OK, now, it's your position that the DOE—that the demonstration programs that you proposed in the act and in the amendment will add little to the design data and inservice experience already being accumulated?

Ms. **Fitzpatrick**. Yes, sir; because the purpose of the demonstration is to gather information on emissions and design data. Then, those are the types of things that should not be done in an inservice fleet environment; they should be done in a controlled laboratory environment.

Mr. **Glickman**. Well, what kind of data does the DOE have regarding fleet operations of methane vehicles?

Ms. **Fitzpatrick**. The fleets are being operated by private owners, about half of them by natural gas utilities around the country, 80 or more natural gas utilities, in a variety of climatic and geographic, altitude, wet, dry conditions.

The information that comes out of that indicates that there are no barriers to the use of methane as a vehicular fuel because of climatic and geographic conditions. Any problems that have arisen have been surmountable. In fact, in some situations methane is probably preferable to gasoline. It's a—it has better cold-start characteristics, for example, because it's already a vapor, and you don't have to vaporize a very cold fuel on a winter morning.

All of that information is being gathered by the American Gas Association because they are actively pushing to open up what they consider a very large potential market for natural gas. They hold seminars and meetings. They issue papers and reports. We exchange information with them on an ongoing basis. We have that information, and that information is also available to anyone who is interested in running a methane fleet.

Mr. **Glickman**. Have you published any kind of report that would be useful to someone trying to make a decision on fleet conversions or would they have to go elsewhere for that kind of information?

Ms. **Fitzpatrick**. We have not published a report ourselves. We would supply them with the American Gas Association information, which is quite up to date, or direct them to the AGA for further information.

Mr. **Glickman**. OK. In addition to the work that you have been conducting on methane-fueled vehicles, what additional research do you think is needed?

Ms. **Fitzpatrick**. We want to continue research on diesel applications, both for railroad and automotive and truck use. We also are very interested in continuing our work on low pressure storage of methane to try to solve some of the space and weight problems that the size of the storage tanks on the vehicle cause.

We also want to continue—or being work on—the problem of contaminants in the natural gas. If there are sulfides or water in the natural gas, it causes a serious corrosion problem in the storage and fuel lines.

And, also, we would like to continue work on engine optimization to get the highest fuel efficiency and the lowest emissions possible.

Mr. **Glickman**. And with respect to emissions, have you been working with the EPA on emissions as they would relate to methane-fueled vehicles, and do you have any results?

Ms. **Fitzpatrick**. We have done some work with them in the past, and principally with the opportunity to use their techniques for testing emissions from methane vehicles, and we stand ready to test—to do that again with them.

Mr. **Glickman**. When did you do that?

Ms. **Fitzpatrick**. I believe that was——

Mr. **Brown**. Around 2 years ago.

Mr. **Fleming**. That was done in 1981 and was subsequently published in our report on state-of-the-art assessment of methane-fueled vehicles.

Mr. **Glickman**. So there's been no updating of the emissions aspect with respect to you or the EPA in the last 3 years?

Mr. **Fleming**. No.

Mr. **Glickman**. As a general matter, what did that material show in terms of emissions for methane vehicles, methane-powered vehicles?

Mr. **Fleming**. The results of those tests showed that—I have to first say that those vehicles were standard, dual-fueled vehicles. And there was no changes to the engine other than adding the dual-fuel kit.

The emissions of both carbon monoxide and oxides of nitrogen were somewhat lower than the same vehicle operated on gasoline. Total hydrocarbon emissions was higher for methane than the gasoline version, but you have to recognize that only a very small percentage of those hydrocarbons are reactive in the atmosphere, and, therefore, if you count only the nonreactive hydrocarbons—or I should say if you count only the reactive hydrocarbons—then they were much lower than the gasoline.

Mr. **Glickman**. OK. So, I mean, as a general proposition, the total emission picture looked better with respect to methane than it did with gasoline; is that correct?

Ms. **Fitzpatrick**. Yes, sir, ignoring the nonreactive hydrocarbons, principally unburned methane.

Mr. **Glickman**. OK. Well, I guess my concern is the emissions issue remains a significant issue, and I would hope that additional research would be done in this area, and that you would not let that 3-year-old study just stay there; that you would continue working with the EPA.

You have concluded your study on institutional barriers to the use of methane-powered vehicles. What kind of followup activities have you done in that area?

Ms. **Fitzpatrick**. We have not done any specific followup activities. We have widely distributed a report to the people who are responsible for those barriers or who are most affected by them, and—but we have not done any specific followup studies.

Mr. **Glickman**. Well, for example, FERC, the Federal Energy Regulatory Commission, has some prohibitions on resale of natural gas. I wonder if you have been in contact with FERC at all about that issue.

Ms. **Fitzpatrick**. No. I think those—I think those resale prohibitions are also local to some extent or peculiar to a utility, but we have not made any formal recommendations to the FERC about removing those.

Mr. **Glickman**. Are you planning any followup to your institutional barrier study?

Ms. **Fitzpatrick**. Not at this moment, no.

Mr. **Glickman**. Do you have any idea what kinds of changes in existing laws that you might recommend to remove any institutional barriers to the use of methane-fueled vehicles?

Ms. **Fitzpatrick**. Yes. Two of the institutional barriers we discovered were at the EPA. One has to do with the antitampering regulations that the EPA has. It's illegal to change a vehicle so that its emissions are changed or increased. The EPA is studying that problem with a view to adapting it to methane, to allow methane conversions.

The other problem is, as we mentioned, the nonreactive hydrocarbon emissions, principally methane itself. And EPA would have to change its regulations on nonreactive hydrocarbon levels, emission levels, if they would permit, and they are also studying that issue.

Other institutional barriers, such as the safe design of storage and refueling facilities, should be addressed. Some of these are at the State and local level, as are regulations about transport of methane through tunnels, for example; zoning regulations which would prohibit the location of refueling stations or storage facilities. These really are very widely dispersed and would have to be addressed by local authorities in order to clear away all institutional barriers.

Mr. **Glickman**. OK. Well, I thank you for your testimony.

I—we have, at least temporarily, in this country an enormous supply of natural gas.

Ms. **Fitzpatrick**. Yes, sir.

Mr. **Glickman**. And then when you consider the biomass component of methane, you have an unlimited supply, and I just want to make sure that we remove barriers so that an industry can develop, so that the information base is as great as possible. That was the purpose of the law.

And we appreciate your testifying today.

Ms. **Fitzpatrick**. Well, Mr. Chairman, let me say that we share your enthusiasm for methane and we look forward to working with you to discover the best application of what the Congress and what the Department of Energy can do to clear away some of these barriers, because we do think that methane has a very, very strong potential.

Mr. **Glickman**. OK.

Mr. McCandless.

Mr. **McCandless**. Thank you, Mr. Chairman.

This may sound like an elementary question, but I think it needs to be answered for purposes of building. If we take methane as we're creating it through the biomass process and we compare its molecular structure to that of natural gas that comes from alternate sources of drilling, like oil wells, and so on, do we have any real difference in the composition of the fuel?

Ms. **Fitzpatrick**. The methane itself, of course, is—methane is methane, CH_4, but you're correct, there are differences I think in the mix of what you get along with the methane. I spoke earlier about the contaminants that show up. In methane from a well you do get sulfur contaminants, sulfur dioxide contaminants; you get water, I think in both sources; you get more complicated hydrocarbons which may or may not burn efficiently or may add to the emissions problem. So I think there is always the problem of contaminants, and that's why I mentioned that we would like to continue our research on contaminants—how either to prevent them, if we're making methane from biomass, or how to remove them, if they're a problem and shouldn't be allowed to get into the burning process.

Mr. **McCandless**. During the early seventies in the Los Angeles Basin there was a sincere attempt to find answers to the high level of ozone by alternate fuels that would be more efficient and less contaminating. A number of public agencies, in order to try to stimulate this, lead the way in this conversion process and found it to be very costly and expensive, and the results were very mixed and questionable. As a result, the natural gas, which I will use here in this case, natural gas alternate was not a success. And the reason it was not a success is the cost of maintaining the automobiles, the conversion cost, the additional weight, performance characteristics, and temperatures that ranged from, say, 26 at the Fahrenheit at the low end to 130 degrees at the high end out in the desert areas. So the project was abandoned for those reasons. We didn't get ozone reduction—because unburned hydrocarbons were thought to be less because you'd have more clean burn. You didn't have it. Engine failures of a type where valves, and so forth, increased the unburned hydrocarbons, and so on.

Have we moved from that era into a new era as far as the application to our conventional engine as we see it on the street is concerned?

Ms. **Fitzpatrick**. Mr. McCandless, I think you've very aptly identified some of the serious market barriers, practical barriers, to methane use in vehicles. And the problems that you've spoken about are the ones that we would like to address in our continued research on engine design, for example, to get cleaner burns, more efficient burning.

The storage problem is a serious one. You mentioned operation and maintenance costs. So that we need better design for less expensive storage, and that has to do with the volume of the tank and the material that the tank is made from. This is both for on-ground storage for the refueling facility and for the vehicle itself.

And we have serious tradeoffs in the vehicle between the range of the vehicle and the amount of space that you have in the vehicle, either for passengers or for cargo, because to get a range of, say, 250 to 300 miles, which would be comparable to a gasoline-powered vehicle, you're going to have to put in tanks that will take up just about all the space that you have for everybody but the driver and a passenger—and a couple of passengers and weigh 600 pounds or more. And so you have a very serious tradeoff between space, payload weight, and range. And I think that that adds to the maintenance and operation cost.

So these are some of the problems that we're trying to address: better storage techniques, better engine design. And I think that is the way that the Government should go in its research program.

Mr. **McCandless**. At the expense of oversimplifying it, it appears to me that every aspect of using natural gas or methane as an alternate fuel has some disadvantage, some problem, rather than parts of the puzzle having problems that could be addressed and resolved, giving you a complete picture of a favorable nature.

This program has been in operation in southern California now for in excess of 15 years, and in the last 10 years to a major degree, as an alternate source for vehicles. And the program has not received favorable results, even with the increase in knowledge and technology as a result of use.

My question, I guess, is, is there light at the end of the tunnel with all of the variables that we have to deal with here and all of the negative aspects?

Ms. **Fitzpatrick**. I think, as with many of our technologies, Mr. McCandless, there is light at the end of the tunnel if we can make some technological breakthroughs and always keeping in mind what the market forces are. Some technologies are not feasible if oil prices are at a certain level; they become very attractive if oil prices change. And we know at least in the long run, looking into the 21st century, oil prices will have to change because oil eventually will run out, and the question really is a matter—is one of time: how quickly can we—how should we apply our resources now to be ready with the technology that we will need when the economic factors make the fuel attractive?

Mr. **McCandless**. You have, of course, in our chairman's home State wheat—methanol.

Ms. **Fitzpatrick**. Yes, sir.

Mr. **McCandless**. That's certainly an option. If we can't eat it, we burn it; right?

Mr. **Glickman**. Or we can eat it and burn it both. [Laughter.]

Ms. **Fitzpatrick**. That's true. We can make the ethanol and get a very high grade—what we would hate to call a waste product because it's a very high grade food source.

Mr. **McCandless**. And on occasions it's been—it's also been drunk; isn't that right?

Mr. **Glickman**. Right. Not in our State of Kansas but in California. [Laughter.]

Mr. **McCandless**. Thank you very much.

Thank you, Mr. Chairman.

Ms. **Fitzpatrick**. Thank you, sir.

Mr. **Glickman**. Well, we appreciate your testimony. And, as we look through this legislative process, we will continue to work with you.

I still believe, as you do, that the price of petroleum will both go up and diminish in the next several years to come; that this Nation retains its flexibility, capability, and, so to speak, even freedoms by our mobility, and that mobility is an individual-based mobility as opposed to in other parts of the world where they demand mass transit in far greater amounts than we do here. And I don't think we'll ever go as much mass transit in this country because of our size. Therefore, we need something to fuel individual vehicles, and I want to make sure that one alternative, which is really feasible now, which doesn't require a lot of exotic work on it, as some of the other energy alternatives—that we get the bugs out of it and we get the institutional barriers away from it. And I think we're working at the same goals. It's just that perhaps I may want to see the Government do a little more than they're doing at the present time.

Ms. **Fitzpatrick**. Yes, sir, and we do appreciate your interest and support.

Mr. **Glickman**. Thank you very much. We appreciate it.

Ms. **Fitzpatrick**. Thank you, sir.

Mr. **Glickman**. Sure.

Our next witness is Mr. Jack Shaffer, distinguished member of the board of directors of Beech Aircraft Corp. in my home city of Wichita; former Administrator of the Federal Aviation Administration.

I think, Jack, you're accompanied by Roy Adkins as well.

So we're delighted to have you here. Perhaps you can tell Mr. McCandless a little bit about the benefits of natural gas as a motor fuel as well.

STATEMENT OF JOHN H. SHAFFER, MEMBER, BOARD OF DIRECTORS, BEECH AIRCRAFT CORP., WICHITA, KS, ACCOMPANIED BY ROY ADKINS, DIRECTOR, ALTERNATIVE ENERGY DIVISION, BEECH AIRCRAFT CORP.

Mr. **Shaffer**. Well, Mr. Chairman, I'm very happy to be in this hallowed Hall again, but I don't want to take my time up with reading my prepared statement.

Mr. **Glickman**. Your statement will appear in the record in its entirety.

Mr. **Shaffer**. But I would like to say that in that connection I have titled it "Methane Cares," which means that I've given life to an inanimate object, but I don't want you to think that I feel omnipotent or whatever.

I believe it's clean burning. I heard this previous testimony, and I'm not going to be diverted from my intended rounds by that. It's abundant. There's no question about it.

I believe all of my literature certainly suggests that there's at least 95 years of it at the present rate of consumption on the face of the planet. It's available everywhere. That's the nice part about it. Every continent on this Earth has it, and the oceans surrounding those continents are loaded with it.

I don't get into Dr. Hill's deep Earth theory or anything like that. I don't pretend to be a scientist, but I do believe that it's clean and it's abundant.

It's renewable, which doesn't mean that when you burn it in an internal combustion engine you get from the exhaust products a reconstitution and droplets of methane. That's not what I'm talking about. It's renewable because as long as we're honeymooning, we're going to have sewage to dispose of, and as long as we're—have the appetite that we have in this Nation and the rest of the world, we're going to have garbage to get rid of. And it seems to me that we can work more problems than one at a time if we go about it intelligently.

And since the subject of wheat and alcohol came up, I would suggest that if we cogeneration, we could use the heat that's in the cooling towers to boil this wheat, if that's the process at which we're getting to the alcohol. So if we get all of the squeal out of the pig, we can then get the price that we want for the substance that we want to use and find useful.

So it's renewable. And what I just said shores up the argument about economics. It's cheap, and I hate to use that word. It's economical or low cost. It is not cheap. It's a very fine fuel and it shouldn't be cheapened by that adjective. It's not cheap in that respect.

And it's safe. There's been a lot of argument about it, but there's no doubt that in the gaseous form it weighs six-tenths of what the air weighs. As a result, it goes to the top of the atmosphere, if you give it a route to travel. So proper ventilation—these are addressing the codes—proper ventilation of whatever it is, the vehicle or the home or the building, you'll get this kind of safety that you want.

The nice part about this fuel, and the fuel that I'll get to in a minute is one that will answer a lot of the questions, particularly Mr. McCandless'—about the separation of the various, what I would call, unwanted elements that are involved in the natural gas; that's the gas that we extract from the Earth.

We prefer—and I speak for the Beech Aircraft approach to it, from a space program background—the cryogenic fuel because of the temperatures at which the various elements or compounds drop out. It gets to the point where methane is probably the last to go. In other words, it goes liquid last of all those in series.

And those—I'm not—I didn't prepare that part of the testimony, but it is a fact that hydrogen sulfide, for example, goes to liquid much earlier than natural gas or methane goes to liquid. Methane goes to liquid at about minus 258 degrees, or 260 for round numbers, and at that point it's about the last—the only thing that's left. So it's there, and that is the thing that you're looking for.

When we talk about natural gas—and I'm now talking about our approach to it—we're really talking about methane.

And I would like to use something that I've heard in the last day. If we start calling this stuff methane, we'll know what we're talking about. And if we want to talk about that other stuff, we'll call it petro. And then we'll all know what we're talking about worldwide. Methane is one thing and petroleum or petro is another, and gas is an abbreviation of the word "gasoline." So that confuses a lot of people.

But methane is a beautiful fuel. It's safe. It's benign. It's not toxic. You can inhale it, and then you'll get into problems because it displaces the oxygen in your lungs, but it won't be painful. It will be a nice way to go, if you think of it that way. But I'd suggest that we try to guard against that.

It is a really good fuel. And if you take care of the leakage, you're in great shape.

Since I'm wandering a bit—I'm still on the subject of safety—it's lighter than air in the gaseous form, and it's much lighter than relative fuels—that's jet A, or gasoline, or diesel—in the liquid form. It's one-half the weight of gasoline, for example. It's 3.5 pounds per liquid gallon. And that answers the question about the weight of the tank.

The automobile, unfortunately, won't go anywhere with a tank empty, so we don't talk about the weight of the tank; we talk about the weight of the fuel or the vehicle fueled, and at that point it's lighter than any other comparable vehicle fueled with any other useful fuel. So weight is not a subject for really examination. It's a true statement of fact that liquid natural gas is lighter.

I think the problem of the weight comes with the fact that the other form that it's principally used in at the moment—that's the compressed natural gas—has a very heavy cylinder. It contains—it holds the gas at about 2,400 pounds per square inch [PSI], and that requires a fairly strong tank. And there's where the weight comes from.

But we're not here to bad mouth the natural gas business at all, because the compressed people are in the same act that we're in. We only store it in a liquid form. The minute it comes out of that tank, it goes to gas. And when it enters the combustion chamber, it is a gas. It's the same as the natural gas, only it's pure.

So using a—a vehicle using liquid natural gas or natural gas stored as a liquid is, in fact, a superior vehicle in all terms of exhaust emissions. It is a clean-burning fuel because there are no contaminants in it. It is methane, and pure methane. And that, I think, is easy to establish, and I would hope that we don't have to waste too much time with that part of it.

So all I've said is that I believe in the acronym of CARES. It's clean, abundant, renewable, economical, and safe, and that sounds like I have a high opinion of my own background, but I don't mean that at all. I'm educated beyond my intelligence, so I'll establish that fact right here. I've gone to a lot of technical schools and I've spent a lot of time in technical areas, and I've learned a lot from association, and I've absorbed a lot from osmosis. But I'm not a parrot. And I say in my statement I try not—I'm not interested in just originality for originality's sake, but I try to say it in ways that are different from—without trying to call attention to it.

But I do feel, and I've spent a lot longer in methane than most people suspect—we once had a supersonic transport in this country, or a program for it, and that program was the responsibility of Federal Aviation when I was there. We were studying the role of the fuels, and we knew that if we got a lighter fuel we could have a better airplane, because you would sell your mother-in-law for a pound of weight empty in the airplane business or in the space business.

An airplane of the capability of the 747 carrying the same number of people, the same baggage load, the same cargo lift, everything you want to talk about, if it were designed from the start to use a fuel with the qualities of methane, it would lift off, it would rotate at about 330,000 pounds lighter than the present 747 loaded with jet A.

We believe the airplane is the equivalent in most respects on performance when it's in the combustion system. In other words, the thermal efficiency of it is very good. If the Department of Energy would support some of that, I think they could even verify it or come close to saying that it's almost a wash. That's the sort of thing I'm here for.

I'm—in my interest in it, I'm interested in it from the strategic standpoint. I really believe we could, certainly in the northern—North American continent—have a fortress North America if we chose.

I'd hate to have this testimony pick that one up as the most important thing said. I don't think it is at all. But we have neighbors, Mexico and Canada, with a fantastic amount of everything that's needed to be a strong and powerful nation or continent. And in this Western Hemisphere, we've got it all.

And there's four countries that I know of, including the United States, that's awfully wasteful of enormously expensive fuel relative to the one I'm talking about. Mexico, Venezuela, Argentina, and the United States have severe debt problems. And if we go about it intelligently and back out some of the more expensive fuel and use these lower cost and more abundant ones, with less likely interruption of the supply from the standpoint of exhaustion of it than gasoline, we'd be a much more comfortable country.

And these other countries, if they were to do the right thing—and I'm not making an issue of Mexico City, but I've been there, and so have a lot of you. It's got an air pollution problem that you can't believe, and there are people who have suggested that by the year 2000, if something isn't done to reverse the trend, it will be virtually—well, it will be so unattractive that it will be virtually dead as a city. And it's a beautiful place, and they can do something about it. They're presently wasting their natural gas. They're burning, or flaring it, or just venting it.

If they were to put that into their economy in a progressive way, and the progressive way is to teeter—tether—pardon the expression; teeter is something else—tether the fleet operator so you don't have to worry about this infrastructure and the capital costs of recreating the same sort of thing that we have in our gasoline system. You could progressively reduce the amount of smog at Mexico City, because it's a natural place for it; it's at the perfect altitude for inversion, and that's what they have, a thermal inversion, and that's why they have that cloud hanging over the city.

But if they were to take the petroleum and leave that out of the tracking system and sell it off to someplace else, and replace that with the natural gas that they are presently wasting, they would do a lot to strengthen their peso and they would do a great deal for their balance of payments. So that's the end of the economic symposium.

And I've now said what I have to say about what I believe, and I would like to answer any questions that you may have.

[The prepared statement of John H. Shaffer follows:]

COMMITTEE ON SCIENCE AND TECHNOLOGY

26 APRIL 1984

METHANE CARES

A GREAT MANY AMERICANS REALLY NEVER THOUGHT, MUCH LESS BELIEVED, THAT THE OIL CRISIS OF THE EARLY 1970'S WAS REAL. MANY OF THESE SAME PEOPLE ARE NOW SAYING THAT THE CRISIS, IF THERE EVER WERE ONE, IS OVER. ANOTHER GROUP CREDITS REDUCED OIL USAGE -- DRIVEN BY PRICE -- FOR THIS REDUCTION IN OIL CONSUMPTION. IT'S DOUBTFUL THAT THEY CREDIT A WORLDWIDE RECESSION FOR MUCH OF THE DAMPENED DEMAND.

IT IS MY CONVICTION THAT OUR GAINS IN TERMS OF REDUCED ENERGY CONSUMPTION WERE EXTRACTED AT A TERRIBLE PRICE TO AMERICA. RIGHT NOW WE'RE WRESTLING WITH THE IMPORT QUOTAS SUBJECT WITH THE DEBATE SURROUNDING A FAVORABLE TRADE BALANCE OBSCURING CAUSE AND EFFECT. A VERY SIGNIFICANT PERCENTAGE OF THE "TRADITIONAL" U.S. MARKETS -- FOR STEEL, AUTO AND ELECTRONICS PRODUCTS, AND THE TOOLS TO MANUFACTURE -- HAVE GONE AND THESE MARKETS ARE UNLIKELY TO RESTORE.

IT IS THIS VIEWPOINT THAT WILL SERVE AS THE LAUNCH PAD FOR MUCH OF WHAT I HAVE TO SAY ON THE SUBJECT OF THE NEED FOR A COHERENT NATIONAL ENERGY POLICY THAT IS AT ONCE RATIONAL, LOGICAL, SENSIBLE AND ESSENTIALLY NON-POLITICAL.

WE ALSO DESPERATELY NEED A TRANSPORTATION FUEL WHICH WILL KEEP THE U.S. ECONOMY "HUMMING". UNQUESTIONABLY, ENERGY DRIVES THE PRODUCTION PROCESSES WHICH GENERATE ECONOMIC WEALTH AND CONTRIBUTE TO SOCIAL STABILITY. THE MOST PERVASIVE DIRECT COST IN OUR ECONOMY IS THE COST OF TRANSPORTATION, A BIG COMPONENT OF WHICH IS THE TOTAL COST OF THE FUEL (ENERGY) CONSUMED IN THE MANUFACTURING PROCESSES (FROM RAW MATERIAL TO FINISHED PRODUCT). BUT INSTEAD OF SIMPLY WRINGING OUR HANDS IN "HENNY PENNY" DESPAIR LET'S GET OFF OUR COLLECTIVE "BUTTS" AND DO SOMETHING ABOUT THE "FIX" WE'RE IN!

ONE CAN CERTAINLY DISAGREE WITHOUT BEING DISAGREEABLE AND SO I RESPECTFULLY SUBMIT THAT IT IS NOT NECESSARY TO ADDRESS THE PROVISIONS OF THE "CLEAN AIR ACT" WHEN METHANE IS THE FUEL UNDER DISCUSSION SINCE THE EXHAUST PRODUCTS OF BURNING METHANE MEET OR EXCEED THE AIR QUALITY STANDARDS SET BY EPA IN MOST RESPECTS. HOWEVER, I DO QUESTION THE WISDOM OF THE LAVISH FINANCIAL SUPPORT FOR THE ELECTRIC VEHICLE IN THE QUEST FOR CLEANER AIR. IT IS DOUBTFUL THAT TECHNOLOGY WILL PROVIDE, IN THE LIFETIME OF MANY OF THOSE HERE ASSEMBLED, A VEHICLE EQUIVALENT TO THE PERFORMANCE OF THE NATURAL GAS VEHICLE (NGV) IN TERMS OF FUEL COST SAVINGS, EFFICIENCY OF ENERGY RESOURCE UTILIZATION AND QUALITY OF EXHAUST EMISSIONS. I HAVE READ WITH GREAT INTEREST MYRIAD SCENARIOS ON THE ALTERNATIVE ENERGY SUBJECT AND I NOTE WITH GOOD HUMOR THAT THE ELECTRICITY "CROWD" CLAIMS THE ATTRIBUTES OF FLEXIBILITY AND CLEAN AT THE POINT OF END USE IN THEIR PRODUCT ADVERTISING, IN THE EFFORT TO ACHIEVE "FULL PUBLIC UNDERSTANDING OF ITS BENEFITS".

PREVIOUS CONGRESSIONAL HEARING TESTIMONY AND TESTS BY EPA AND GSA HAVE ALREADY ESTABLISHED THAT METHANE IS CLEAN BURNING; IT'S ALSO ABUNDANT; IN FACT, CH_4 IS IN PLANET EARTH IN PRODIGIOUS VOLUME AND MOST FORTUNATELY WIDELY DISTRIBUTED GEOGRAPHICALLY. MANY COUNTRIES, SOME OF WHICH SHOULD KNOW BETTER, CONTINUE TO TREAT NATURAL GAS AS A NUISANCE. MEXICO AND ARGENTINA TO IDENTIFY JUST TWO ALSO SUFFER FROM SEVERE MONETARY PROBLEMS AND LOTS OF NATURAL GAS ALONG WITH THE UNITED STATES. THESE "BIRDS OF A FEATHER" WOULD BE WELL ADVISED TO REDUCE THEIR APPETITE FOR PETROLEUM BY PROGRESSIVELY SUBSTITUTING NATURAL GAS (METHANE) FOR SOME PART OF THEIR GASOLINE AND DIESEL; THE FORMER ON A MONOFUEL BASIS GALLON FOR GALLON, THE LATTER BY A FUMIGATED MIXTURE -- ROUGHLY IN THE RATIO OF 83:17 NATURAL GAS TO DIESEL. FOR INSTANCE, WITH JUST ONE STRAIGHT FORWARD BUSINESS DECISION THE LEADERSHIP OF MEXICO COULD PERFORM A MODERN MIRACLE -- THE CLEAN UP OF THE AIR POLLUTION SO STRONGLY IDENTIFIED WITH MEXICO CITY, WHILE STRENGTHENING THE PESO BY CAPITALIZING A PRESENTLY WASTED RESOURCE, INSTEAD OF CONSUMING ALMOST EXCLUSIVELY MORE EXPENSIVE FUELS - GASOLINE, DIESEL AND PROPANE - IN THE LOCAL ECONOMY. SUCH A DOMESTIC POLICY WOULD RELEASE SIGNIFICANT BARRELS OF CRUDE FOR EXPORT WITH AN ACCOMPANYING POSITIVE IMPACT ON ITS TRADE BALANCE.

TO INSURE THAT OUR FRIENDS SOUTH OF THE BORDER DON'T CONCLUDE THAT THEY'VE BEEN SINGLED OUR FOR CRITICISM, THE USA COULD AND SHOULD FOLLOW MUCH THE SAME POLICY. IN FACT OVER TIME IT IS CLEAR THAT THE U.S. COULD OFFSET THE REQUIREMENT TO IMPORT CRUDE (WITH THE EXCEPTION OF PURCHASES FROM MEXICO AND CANADA BY CHOICE). OBVIOUSLY SUCH A CONSCIOUS DECISION ON OUR PART COULD GREATLY SIMPLIFY THE FOREIGN AFFAIRS STRATEGY OF THIS BASTION OF FREEDOM AND INDEPENDENCE.

I USE THE WORD RENEWABLE TO MAKE THE ACRONYM "CARES" BUT I DIDN'T MEAN TO SUGGEST THAT THE EXHAUST PRODUCTS OF BURNING METHANE IN INTERNAL COMBUSTION ENGINES WILL NATURALLY DISSEMBLE IN THE ATMOSPHERE AND THEN NATURALLY REASSOCIATE AS METHANE. HOWEVER, THERE ARE URBAN AND ANIMAL WASTES, BIOMASS AND GARBAGE IN LANDFILLS, SEWAGE TREATMENT TO NAME JUST A FEW OF THE REUSABLES THAT MAKE GOOD ECONOMIC AND BASIC SOCIETAL SENSE WHEN CONVERTED TO A TRANSPORT FUEL. FOR EXAMPLE, I SUBMIT THAT A FAIRFAX COUNTY LANDFILL, JUST OFF I-66 COULD PRODUCE SUFFICIENT METHANE TO FUEL MOST OF THE COUNTY'S SCHOOL BUS FLEET AND POLICE CRUISERS. THESE ACTIONS COULD RESULT IN BETTER EDUCATION FOR THE STUDENTS AND ADEQUATE POLICE PROTECITON AT LOWER COSTS THAN PRESENT PRACTICE.

IN CASE IT ISN'T SELF EVIDENT, I AM SAYING EXACTLY WHAT I BELIEVE AND I'M NOT TRYING FOR ORIGINALITY IN ORDER TO AVOID REPEATING WHAT SOMEONE ELSE MAY HAVE SAID BEFORE EITHER TODAY OR ON SOME PREVIOUS OCCASION.

PURSUING THE RENEWABLE ENERGY THEME A BIT FURTHER, I CALL YOUR ATTENTION TO THE FACT THAT RAW SEWAGE IS STILL BEING DUMPED INTO BOSTON HARBOR TWELVE YEARS AFTER CONGRESS APPROVED LEGISLATION TO CLEAN UP THIS NATION'S WATERS. PROPERLY EQUIPPED TREATMENT PLANTS AT DEER AND NUT ISLANDS COULD PRODUCE VERY SIGNIFICANT QUANTITIES OF METHANE WHILE "WORKING" THE CLEAN WATER PROBLEM BY PROVIDING A REVENUE STREAM WHICH WOULD CERTAINLY PARTIALLY OFFSET THE COSTS OF THE CRITICAL CLEAN UP OF THE HARBOR.

STATED DIFFERENTLY I SUGGEST THAT THE VARIOUS DEMONSTRATION PROJECTS ENVISIONED BY THIS LEGISLATION STRIVE TO RIGHT MORE THAN ONE WRONG SIMULTANEOUSLY AT A LOWER TOTAL CAPITAL COST THAN WOULD BE NEEDED FOR THE DESIRED PROGRAMS INDIVIDUALLY.

MOVING FROM ENVIRONMENTAL IMPACT TO THE QUESTION OF ECONOMY, THE U.S. POSTAL SERVICE PROJECT AT DECATUR, GEORGIA CONFIRMED LOWER FUEL COSTS 9.9 CENTS PER MILE FOR CNG COMPARED TO 14.9 CENTS PER MILE FOR GASOLINE; THE COST ADVANTAGE CLAIMED FOR NATURAL GAS VEHICLES IS BASED ENTIRELY ON THE FUEL COMPONENT AND DOES NOT CLAIM CREDIT FOR LOWER MAINTENANCE SUCH AS LESS FREQUENT OIL CHANGES, LONGER SPARK PLUG AND EXTENDED ENGINE LIFE. OBVIOUSLY A GREATER NUMBER OF MILES DRIVEN PER VEHICLE WOULD INCREASE THE TOTAL PROFITS AND ACCELERATE THE PAYBACK OF THE EXPENSE OF VEHICLE CONVERSION AND THE FUELING STATION INVESTMENT.

THE SAFETY QUESTION HAS BEEN RAISED FREQUENTLY AND RIGHTLY SO BUT THERE ISN'T ANY DOUBT THAT THE LIGHTER GAS (SIX TENTHS [0.6] THE WEIGHT OF AN EQUAL VOLUME OF AIR) DISSIPATES QUICKLY IN THE EVENT OF A SPILL. OF EQUAL OR GREATER SAFETY SIGNIFICANCE IS METHANE'S HIGHER IGNITION TEMPERATURE (1170° VERSUS 680°F FOR GASOLINE, 750°F FOR PROPANE AND 500°F FOR JET-A). THERE IS AN ENORMOUS AMOUNT OF OPINION ON THIS SUBJECT BUT SUFFICE FOR NOW IS THE MOST FREQUENTLY EXPRESSED RISK EVALUATION THAT "A WELL DESIGNED CONVERSION WITH PROPER INSULATION, INSPECTION AND MAINTENANCE APPEAR TO NO GREATER RISK THAN GASOLINE POWERED VEHICLES".

IT'S QUITE POSSIBLE THAT THERE WILL BE LESS THAN TOTAL AGREEMENT WITH MY VIEWS BUT AT LEAST YOU KNOW WHERE I'M COMING FROM AND WHAT MOTIVATES ME TO CONTINUE TO WORK IN THIS VINEYARD. I CAN'T THINK OF ANYTHING MORE NECESSARY THAN SEEING "DEMONSTRATIONS" OR VALIDATION "TESTS" FOR CH_4 IN AS MANY TRANSPORTATION MODES AS POSSIBLE - AIR, WATER AND LAND - WITH THE FUEL DERIVED FROM AS MANY SOURCES AS ECONOMICALLY AND TECHNICALLY FEASIBLE - COAL SEAMS, "SHUT IN" WELLS, AGRICULTURAL WASTES, WASTE WATER TREATMENT, SANITARY LANDFILLS AND NATURAL GAS PURCHASED FROM THE GAS UTILITY INFRASTRUCTURE (MORE THAN 105 PEAK SHARING PLANTS PLUS MORE THAN 1 MILLION MILES OF GAS TRANSMISSION AND DISTRIBUTION PIPELINES INSTALLED).

(SECRETARY HODEL'S REMARKS TO THE WASHINGTON INTERNATIONAL ENERGY FORUM ON 25 JANUARY 1984 ARE RECOMMENDED FOR CAREFUL AND THOUGHTFUL READING AND SHOULD BE INCLUDED IN THE RECORD OF THIS HEARING AS PART OF THE LEGISLATIVE HISTORY).

Mr. **Glickman**. Thank you.

Let me ask you this: what do you think needs to be done at the Federal level to facilitate the use of methane as a vehicular fuel that is not being done now?

Mr. **Shaffer**. Well, I think the Secretary from the Department of Energy said it. We need a national standard, so that we don't have this colloquial approach to, well, the institutional barriers and those things that are impediments to the over—or the widespread use of fuels. In every State and in every city virtually you have a different attitude, and that attitude does interfere with the use of transportation, particularly—or the use of this fuel in transportation, particularly interstate transportation.

So I would like to see a national standard, and this national standard established by sensible, rational, logical, nonpolitical, thinking people. I don't mean nonpolitical in the context of the Congress of the United States. I'm talking about don't be thinking about it as to how they'll react to it, meaning the OPEC countries or whatever else. We're not trying to——

Mr. **Glickman**. On the issues of refueling and emissions, it strikes me that those are a couple of the areas where more work needs to be done. That was one of the reasons why I wanted them to go ahead and do some demonstrations in that area. How do you feel about that?

Mr. **Shaffer**. Definitely. I think the dispensing station is—or what we call the service station in today's environment—the dispensing equipment needs some work. It's a cold fuel that we're talking about, and of course it's a laborious task in the compressor or the compressed scheme. It requires a lot of equipment and a lot of, I guess, very high performance shutoff valves and all that sort of thing, because they're handling the fuels different from the one that we're chasing ourselves; that's the liquid.

We believe that the liquid stored at ambient pressure virtually but at colder temperature is an easy fuel to handle if you're careful about it. It's the same kind of problem that we already have coped with on a national basis, the nitrogen trailers or the nitrogen-cooled, big trailers that haul the fresh produce to market. That's a very cold fuel—not a cold fuel; it's a cold substance, and it does have the same characteristics.

The dispensing of this fuel with the minus 260 degrees is—it's a—no question, it's a handicap. It's a restraint to the overall or common use of it. I don't believe you'll see much self-serve liquid natural gas. You could, but I don't believe that that's the approach. I'd like to see more work done in that area certainly, and I believe you would agree with that.

Mr. **Adkins**. That's correct.

Mr. **Shaffer**. Dispensing is a problem.

Mr. **Glickman**. Mr. McCandless?

Mr. **McCandless**. Thank you, Mr. Chairman.

I was interested in your comment about the savings of weight in this 747 scenario that you presented, and also in your written testimony you talk about Mexico City and problems they have there.

If we were to take that proposal or idea and implement it into the society of Mexico, as you're proposing, and we were to also leave as it currently exists the attention, the direction, the maintenance level, the age, and all of the other things involved in the "Mexican vehicle," quote, unquote, would we really have what it is that you're talking about in the way of less emissions than we currently have, realizing that on paper all of this looks good, but in practice when you have a car that's got 150,000 miles on it, which many of the vehicles do and even more, then the unburned hydrocarbons, and so forth, are not going to look as good as they did on paper.

Mr. SHAFFER. I agree with you 100 percent on that. You're now addressing the condition of their fleet or their total automobile or automotive population. Yes, they run some rather broken-down pieces of equipment.

Again, I don't want to start a border conflict. I'm simply saying that your observation is the same as mine. The only people who maintain those cars properly in that country are the foreigners. I think that's a fact, and I've discussed this—I don't intend to belabor the point, and I believe that there's a way to do it there, and I think there's possibly a motivation for doing it. And I'm not picking on the Mexicans. I really do believe that they need desperately to do something about the quality of the air they breathe. I think it will do a lot for them, if it doesn't do anything more than just prolong the lives of their people without having respiratory failure.

Mr. MCCANDLESS. I didn't want to single the Mexicans out for something unique, but I wanted to use that to illustrate a point: That the average motorist—that's an extreme, Mexico, because of the economic level of the people and the fact that as long as that thing runs they're going to have it on the highway trying to collect some fares as a taxi.

To a lesser degree, our U.S. car owners are very similar in nature in that they will run a car, a large majority of them will run a car, until there is some kind of a mechanical deficiency, either a miss or something that alerts them to the fact that this car is going to require some kind of attention. And then they present themselves at that location, whatever, of their choosing, as if they were going to the dentist fully expecting a painful experience.

And so what you have is substandard maintenance, very little preventive maintenance, which people in fleet operations, and so forth, in our country are used to and know is important.

In that kind of a scenario, are we really going to accomplish anything here as far as what it is we're seeking in the way of lower pollution, more efficient operation, less actual use of the natural resource itself?

Mr. ADKINS. I'd like to respond to the first question that you posed. In all of Mexico there's approximately 4.2 million vehicles. Over 2.1 million of those are located in Mexico City. The Mexican Government has identified 178,000 vehicles that would be the candidate fleet-operated vehicles: the major new metropolitan buses, which are diesel; the police cars, which are gasoline powered and diesel; some of the industrial fleet operations, such as cement—they use a tremendous amount of cement in Mexico; they have very large fleets; the postal service in Mexico.

And you're right, the average age of the vehicles in Mexico, privately owned and the Tijuana taxicab-type Volkswagen, is around 7 years. Those are not the initial candidates that the Mexican Government, PMX, have identified.

The ones that they have identified are the ones that would be most easily converted and would provide the greatest benefits concerning air quality and their emissions, and would also provide the greatest economic return on investment.

Mr. **McCandless**. I may sound like I'm negative but I don't mean to be. I'd like to see all kinds of sources, but, unfortunately, I've had some rather lengthy experience in the earlier years of this gas conversion thing that did not leave me with anything in the way of a positive attitude toward the program.

The other aspect of it, speaking now with the aircraft field, do we have anything in the way of actual use of this airborne as a fuel of any consequence?

Mr. **Shaffer**. No, we're not very far along on it. We have flown—Beech Aircraft has flown—a small airplane, the Sundowner, on natural gas.

Mr. **Glickman**. If the gentleman would yield, Mr. Carney and I both flew in that airplane. We made it back very successfully.

Mr. **McCandless**. And there was no feeling of euphoria as you were up there? [Laughter.]

Mr. **Glickman**. No, we were as—no more euphoric than we already were. [Laughter.]

Mr. **Shaffer**. There's another program, and Roy can talk about it. It's the Army TH——

Mr. **Adkins**. Helicopter program.

Mr. **Shaffer** [continuing]. TH-55 helicopter program.

Mr. **Adkins**. We're currently under contract to the Army. We've finished our bench test. We're starting the aviation test, the flight test, this month.

The experience that we have in our own aircraft is that our fuel flow rates are almost identical to AVGAS. We have been able to lower our operating costs from approximately $48 an hour down to $21 an hour. The objective there, of course, is the Emory Riddle Flying School operating environment and getting the young student pilot back into the airplane.

The Army's objective, of course, is to lower their fuel bill. They have purchased their liquefied methane on a competitive buy of 42 cents a gallon from a local gas utility company.

The other thing is that they anticipate increased airworthiness and survivability of their flight personnel.

The three things that are coming out of the Army program are: No. 1, the certification of liquefied methane as an aviation fuel. The second thing which has already been accomplished is the airworthiness certification of the fuel system conversion components, and the third objective will be the overall certification of the airframe, the conversion system, and the fuel. And that, in my opinion, is a typical demonstration project which is being done in the private sector, was initiated in the private sector. It was welcome by the Department of Defense and the Department of the Army, and is moving along at its own pace with no other outside influence that I know of.

But those type of programs, if they were conducted by our Department of Energy, would provide the same type of technical fall-out that the Army is receiving from their program and that we have received from our own program with the Sundowner in-house, which we, in turn, provide to the—again, the Emory Riddle-type flying school.

Mr. **McCandless.** If I may, just two quick questions to kind of bring myself up to speed on this:

First, how do you address the additional weight? Are you using some type of special metal tanks?

Mr. **Adkins.** No; the tanks are the same as they are for automotive. They are 304 stainless steel innertank and a carbon steel outertank. And as for the automobile system, our tanks are approximately 10 to 12 percent lighter fully fueled than the automotive tanks. And in the case of the aircraft, they're over 15 percent lighter because we use 5083 series aluminum for the innertank. And so we're able to haul the same amount of fuel and do the same mission for the Army, but at an overall reduced cost—I'm sorry—reduced weight.

Mr. **McCandless.** How do you address the issue of taking unfriendly fire as far as——

Mr. **Adkins.** The Air Force pretty well established that through their own tests at Wright Patterson, and we've used that in previous committee hearings. The Air Force fired incendiary bullets into tanks of it with external emission sources, and, as NASA pointed out in their studies with the supersonic transport, if you could use liquefied methane as an aviation fuel, you could anticipate a reduction in airline fatalities by up to 80 percent. So, again, the Army feels that the survivability aspect would be increased with the use of liquefied methane versus the JP fuels or the AVGAS fuels.

One of the things that you need to take into consideration is the hot surface ignition temperature of methane at 1,107 degrees versus AVGAS at around 600 degrees and I think JP at about 580 degrees.

Mr. **McCandless.** Thank you.

Thank you, Mr. Chairman.

Mr. **Glickman.** Thank you both for testifying today. We appreciate it very much.

Our next panel is Mr. Frank Jeffrey, manager, market planning and research, Consolidated Natural Gas, in Pittsburgh, and chairman of the Natural Gas Vehicle Committee of the American Gas Association, together with Dr. Robert Mulvin, administrator, Harbor Creek School District, Harbor Creek, PA.

STATEMENT OF FRANK JEFFREY, MANAGER, MARKET PLANNING AND RESEARCH, CONSOLIDATED NATURAL GAS SERVICE CO., ON BEHALF OF THE AMERICAN GAS ASSOCIATION

Mr. **Jeffrey.** Thank you, Mr. Chairman, Mr. McCandless.

Mr. **Glickman.** You may proceed.

Mr. **Jeffrey.** Thank you.

I'm Frank Jeffrey, and I'm manager of market planning and research for Consolidated Natural Gas Co. Consolidated is one of the largest natural gas companies in the country and a totally integrated company.

I also serve as chairman of the American Gas Association's Natural Gas Vehicle Committee. The primary assignment of that committee is to assess the development of and the requirements for effective commercialization of methane-powered vehicles. And it's in that capacity that I am here today.

The American Gas Association is a trade association comprising nearly 300 natural gas distribution and transmission companies, and we serve nearly 160 million customers in all 50 States.

The AGA is pleased to present this statement on Mr. Glickman's proposed amendment to the Methane Transportation Research, Development and Demonstration Act of 1980. We support this amendment because we feel that the Glickman amendment would provide an effective incentive to conduct demonstrations on natural-gas-powered vehicles.

In overview, the position of the American Gas Association is as follows:

One, the Glickman amendment should be more effective than the act in encouraging demonstrations because it would allow grants to be made to public and private entities to defray the reasonable and necessary cost of demonstrations. And the act does not contain a similar provision.

Two, all demonstrations aimed at improving fuel efficiency, as well as those aimed specifically at reducing emissions, should improve total emission levels.

Greater fuel efficiency, of course, results in lower fuel levels—lower levels of fuel consumption for equal driving distances, and the less fuel you use, the less emissions you're going to have.

Three, demonstrations encouraged by the Glickman amendment could speed the widespread commercialization of important technologies, including such as operating diesel engines with methane-diesel mixtures, dual-fueled, methane and gasoline combined vehicles; dedicated methane-fueled vehicles; and compressed natural gas cylinder improvement of both for onboard the vehicle and for the public refueling station application.

Four, the placement of refueling station demonstration should, we believe, be in proximity to other vehicle demonstration programs, so that we get some synergistic effect on all of the demonstration work.

Five, the Department of Energy to date has been ineffective in promoting research, development, and demonstration of methane-fueled vehicles under the act.

I would like to address each of these points in a little bit greater detail.

As a trade association, we agree with the Department of Energy that much work can and must be done in the laboratory, but to achieve the ultimate objective that the Congress had in mind when they passed the 1980 act, we believe that the product of the laboratory research is going to have to go out and face the realities of everyday operation over some extended period of time. Mr. McCandless just illustrated that point, I think rather adequately, when he said: "What are we going to do with vehicles that have been operating for 150,000 miles? What is the impact on those vehicles?" And I really think that having some vehicles out there that have been operated under controlled conditions and well maintained or well monitored, but in very real application, I think will shed us a lot of light that may not be necessarily coming from a laboratory condition.

The second reason why I think that there is a strong need for demonstrations is that many things that are demonstrated in the laboratory tend to fall on their face when it comes to commercialization. Either there are sufficient hurdles to market penetration that early adopters will not pick it up and communicate the results or it just may be that there are disincentives to proceed ahead. And I think that a controlled and well-monitored demonstration program may in many cases eliminate some of those disincentives and help to reduce some of the barriers to further market penetration.

The act currently provides that DOE may furnish technical assistance and financial assistance for data acquisition and reporting requirements on demonstrations. I think it's important to remember that such assistance would defray only a very small portion of the demonstration cost, and, therefore, leave the sponsor of the demonstration with a fair amount of capital at risk.

To put this into some perspective, the Consolidated Natural Gas System is sponsoring a demonstration of a dedicated single-fuel, methane-powered schoolbus. The bus—two brandnew buses were acquired. One is remaining on gasoline; the other one has been converted according to Ford Motor Co. specifications to operate totally dedicated natural gas.

The capital cost, excluding the purchasing price of the buses, just the cost of converting the buses and the associated hardware, is approaching $30,000. Because we recognize that a gas company might not be the most objective source of information on the use of natural gas, we retained a university professor to collect and analyze the data, and his fee is going to be about one-tenth of the capital cost of the project.

So the funds that are required for data gathering and reporting are really a very small proportion of the total cost of any demonstration program. And, frankly, there are relatively few consolidated natural gases around who are willing to put this kind of money into a project.

To the best of the American Gas Association's knowledge, no demonstration has been undertaken pursuant to the act. And that suggests to us that financial assistance only for data acquisition and reporting provides an inadequate incentive.

We believe that the proposed amendment will help remedy the situation by allowing the Department of Energy to make grants to public and private entities to cover reasonable and necessary costs for the demonstration.

A number of years ago, probably 2, 2½, we sat down to talk with Ford Motor Co. Now Ford Motor Co. has been very active in developing engines specifically designed to operate on methane, and Ford told us then, and has told us repeatedly since then, that they are right now prepared to manufacture methane-powered vehicles, but only when it's clear to Ford that there will be sufficient demand. The tooling cost, the testing cost, the marketing cost of bringing a new engine to market are so substantial that Ford is going to have to sell a lot of these vehicles each year in order to get a return on that investment.

The demand for those natural gas vehicles, however, cannot materialize until vehicle owners are confident that they can get fuel in their car, their truck, or their bus. I'm certainly not going to buy a natural-gas-powered vehicle if I don't think I can get natural gas to run that.

As Dr. Fleming pointed out, methane burns characteristically with low level of noxious emissions, and we feel that there is the opportunity to reduce those levels of emissions even more technologically, and that total emissions could be reduced as a function of combustion efficency. A totally dedicated engine, for example, which is designed specifically to operate on natural gas and is optimized for operating on natural gas may, in fact, result in fewer emissions simply because of the better combustion of the fuel, more efficient combustion of the fuel, and the more efficient operation of that engine, which will get you more miles per Btu.

Emissions do increase or decrease proportionately with fuel consumption, and, therefore, total emissions could be reduced as a function of efforts directed toward increased fuel efficiency.

An attractive side benefit would be lower overall operating costs, which is a very significant issue in today's market.

The American Gas Association recommends that demonstration projects not be confined solely to projects involving technology to reduce emission levels, but also include projects which focus on increasing fuel efficiency, which we believe would have a comparable result.

The American Gas Association believes that there are four areas that could benefit from demonstrations envisioned by the proposed amendment.

First, as anyone who has ever driven behind a diesel-powered bus knows, diesel engines emit very high levels of particulates. Reduced emission levels and operating cost efficiencies can be achieved by converting these diesel engines to operate on a mixture of methane and diesel fuel. A number of people have done this on a laboratory basis, but it has not, to the best of our knowledge, been tried in the real world.

A demonstration project, if we could get it tried in the real world and get the blending of natural gas and diesel fuel, I think could result in substantially improved air quality in a number of the major urban areas.

Second, public entities such as municipal governments and school districts, use vehicles in a multitude of ways, and yet they generally have very little capital with which to experiment to do demonstrations of new technology.

In our particular service territory, which is West Virginia, Ohio, and Pennsylvania, several school bus fleets have converted, and these are high candidate-type conversions. School buses get somewhere around 5 miles to a gallon of gasoline. It's largely stop-and-go driving, which is highly pollutant.

If you think about what's happening to school districts with their fleet operations, the increase in fuel prices has required them either to raise taxes to cover the increased cost of operating that fleet or else to make cuts elsewhere. And school districts are not in the business of buying fuel or running buses, but in the business of educating children. So this presents a real dilemma to them.

And many school superintendents almost literally laid their job on the line taking the risk to convert their buses to natural gas, so that they could achieve this economy of operating on lower-cost fuel. It was a daring act in many cases and an almost desperate act to try to live within their means.

But we believe that an adequate demonstration program—and by adequate demonstration program, I'm really thinking of something that has been well-monitored, well-controlled, and the results of which are reported or very reliable—should make such risk-taking on the part of municipal executives to be unnecessary.

Third, we think that further development of fuel cylinders should lead to increased safety, and especially as it centers around the comparison of steel and aluminum materials and how they may be corroded by the nonmethane properties in natural gas.

Fourth, vehicles designed specifically to run on methane may be easier and less costly to maintain and more efficient than vehicles that are dual-fuel capable.

We recommend that the DOE guidelines for the demonstration place emphasis on the four areas that we mentioned above.

With regard to public fueling stations, our concern about methane refueling stations is whether they have the flexibility and the capacity to serve quickly a variety of vehicles. Such a capability, of course, is necessary for efficient capital utilization and to get the necessary investment to build such an infrastructure of refueling stations.

If the refueling station demonstration were located close to some of the other demonstration projects, we believe that a variety of vehicles could refuel there, and, thus, the refueling station could determine how its facilities can be used best for different types of vehicles and the variety of vehicles can garner the benefits of what's learned at the refueling station. In this way, the projects will augment each other and provide significantly more useful information than if they were located separately and operated independently.

To date, the Department of Energy has funded only feasibility studies under the act. As noted above, AGA is aware of no demonstration projects that have been undertaken under the auspices of the act. Of course, this lack of demonstration project fails to address the primary impediment to more widespread use of methane-fueled vehicles, and that's the development of a refueling system in concert with the level of demand for fuel that justifies the necessary capital investment.

We believe that the proposed amendment should provide incentive for demonstration projects that fill the void that has existed regarding DOE's implementation of the act.

We are pleased that the Department of Energy agrees with the natural gas industry that natural gas is an excellent motor fuel for many fleet applications. We believe that the enhanced development of methane vehicles will occur; that institutional barriers can be overcome. The Federal Government, through appropriations to the Department of Energy, can play an instrumental role in overcoming these barriers.

I thank you for giving me the opportunity to talk with you, and I would like to entertain any questions, if you have them.

[The prepared statement of Frank Jeffrey follows:]

STATEMENT OF
FRANK JEFFREY
MANAGER, MARKET PLANNING AND RESEARCH
CONSOLIDATED NATURAL GAS SERVICE COMPANY
ON BEHALF OF THE
AMERICAN GAS ASSOCIATION
BEFORE THE
SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS
COMMITTEE ON SCIENCE AND TECHNOLOGY
UNITED STATES HOUSE OF REPRESENTATIVES
ON A PROPOSAL TO AMEND SECTION 7 OF THE METHANE
TRANSPORTATION RESEARCH, DEVELOPMENT, AND DEMONSTRATION
ACT OF 1980
APRIL 26, 1984

Introduction

Mr. Chairman and Members of the Subcommittee:

The American Gas Association (A.G.A.) is a national trade association comprising nearly 300 natural gas distribution and transmission companies serving more than 160 million consumers in all 50 states. Collectively, these companies account for nearly 85 percent of the nation's total annual gas utility sales.

A.G.A. is pleased to present this statement on Representative Dan Glickman's proposed amendment (hereinafter referred to as the Glickman amendment) to Section 7 of the Methane Transportation

Research, Development, and Demonstration Act of 1980 (the Act). Because the Glickman amendment would provide a more effective incentive to conduct demonstrations than the Act in its current form, we support this amendment.

Summary of A.G.A. Position

- The Glickman amendment should be more effective than the Act in encouraging demonstrations because it would allow grants to be made to public and private entities to defray the "reasonable and necessary cost" of the demonstrations. The Act does not contain a similar provision.
- All demonstrations aimed at improving fuel efficiency, as well as those aimed specifically at reducing emissions, should improve total emissions levels. Greater fuel efficiency, of course, results in lower levels of fuel consumption for equal driving distances; the decreased fuel consumption thus reduces total emissions.
- Demonstrations encouraged by the Glickman amendment could speed the widespread commercialization of important technologies including: operating diesel engines on methane-diesel mixtures; dual fuel (methane/gasoline) vehicles; dedicated methane-fuel vehicles; and compressed natural gas (CNG) cylinder improvements, both for on-board (vehicle) storage and operations in refueling stations.
- The placement of the refueling station demonstration should be in proximity to other vehicle demonstration programs so that they may have a synergistic effect on the potential growth of a filling station network.
- The Department of Energy (DOE), to date, has been ineffective in promoting research, development, and demonstrations of methane-fueled vehicles under the Act.

Incentives for Demonstrations

The Act currently provides that DOE may furnish technical assistance associated with the acquisition or modification of vehicles to be fueled with methane. It also allows DOE to provide financial assistance with respect to data acquisition and reporting requirements for demonstrations. However, such

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financial assistance would defray only a rather small proportion of the demonstration costs and, therefore, leaves the sponsor of the demonstration at risk for the majority of the costs. The fact that no demonstrations (to A.G.A.'s knowledge) have been undertaken pursuant to the Act indicates that financial assistance only for data acquisition and reporting provides an inadequate incentive. As a result, we have a situation wherein methane vehicles cannot be sold widely because of inadequate public refueling facilities, and the construction of public refueling facilities cannot be financed because there are too few methane vehicles to create significant demand for fuel.

The Glickman amendment will help remedy this problem by allowing DOE to make grants to public and private entities to cover the "reasonable and necessary" costs of the demonstrations. This provision reduces the capital risk for a potential sponsor of a demonstration and should provide a far more powerful incentive to initiate demonstrations. With this risk reduced, there is a greater incentive either to purchase methane vehicles or to undertake construction of a refueling facility.

For methane vehicles to proliferate, the development of refueling facilities must occur in concert with more widespread use of the vehicles. That is, there must be an adequate and easily accessible system for providing fuel to methane vehicles or else there will be little demand for the vehicles. On the other hand, no business entity will invest large amounts of capital in a refueling station if there is a relatively small number of methane vehicles on the road. A small number of methane vehicles would represent demand for methane at such a low level that the refueling station would not sell enough methane to earn a profit. Therefore, any business that constructs a refueling station, at present, would assume a high degree of risk that it would lose the capital instead. At the same time, consumers will not buy methane vehicles unless refueling stations are easily accessible. To break this "stalemate," either potential methane vehicle buyers must see that fuel will be easy to obtain or business entities must see that there will be sufficient demand for fuel to justify the capital investment in a refueling facility. The demonstrations that would be promoted by the Glickman amendment have the potential to go a long way toward breaking this "stalemate".

Fuel Efficiency and Reduced Emissions

Methane burns characteristically with extremely low levels of noxious emissions. Nevertheless, these emissions could be further reduced technologically, and total emissions could be reduced as a function of combustion efficiency. Since emissions increase or decrease proportionately with fuel consumption, efforts directed toward increased fuel efficiency will automatically induce a reduction in emissions. Increased fuel efficiency will also result in the benefit of lower overall operating costs. Thus, A.G.A. recommends that demonstration projects not be confined solely to those involving improved technology for reducing emissions levels, but also include projects which focus on increasing fuel efficiency.

Focus of Demonstrations

A.G.A. believes that four areas could derive substantial benefits from the demonstrations envisioned by the Glickman amendment. Therefore, we recommend that the DOE guidelines for demonstrations place emphasis on the areas discussed below.

First, diesel engines normally emit relatively high levels of particulates. These levels could be reduced dramatically by converting these engines so that they can run on a mixture of methane and diesel fuel. Given the wide fleet use of diesels, a demonstration project that can show cost efficiencies and reduced emissions levels may, if it promotes widespread conversion of diesels to mixed fuel capability, result in improved air quality.

Secondly, public entities, such as municipal governments, frequently employ vehicle fleets for a variety of uses. However, they generally have little capital which can be used for demonstrations pursuant to the Act. By allowing public entities to obtain grants for the reasonable and necessary costs associated with demonstrations, the Glickman amendment should open the door for municipalities to structure demonstrations in such a way that they can apply the advantages of methane-fueled vehicles to their own needs.

Third, further development of fuel cylinders should lead to increased safety, specifically with regard to comparisons of corrosive quality between aluminum and steel materials. A current thrust in this area is to reduce the weight of the cylinders by using fiberglass reinforced aluminum in their construction, which allows the cylinders to maintain their strength while increasing the fuel capacity of the vehicles. Demonstration projects which can document long term strength of cylinders and the effects on the cylinders of different gas quality nationwide could further quantify the overall safety benefits of CNG systems.

Finally, vehicles designed specifically to run on methane may be easier (and less costly) to maintain and more efficient than vehicles that are dual fuel capable. That is, engine adjustments can be more precise for such dedicated vehicles than for dual fuel vehicles. Consequently, fuel is burned more efficiently. However, the lack of demand for dedicated vehicles is at least partially a function of doubt about whether their use can be advantageous compared to dual-fueled vehicles. Documented cost reductions and lower emissions levels for dedicated vehicles may show that maximum national benefit can be derived by encouraging the development of dedicated vehicles.

Public Refueling Station

The public refueling station demonstration project can be used to maximize the benefits derived from other demonstration projects. One of the concerns with respect to a refueling station is whether it has the flexibility and capacity to service rapidly a variety of vehicles. This flexibility would make a refueling station more attractive to an investor, since it would apply the use of his capital more efficiently and increase the potential profit from this investment. Therefore, A.G.A. recommends that the refueling station demonstration be located close to other demonstration projects. This would allow a variety of vehicles (and the uses to which they are put) to garner the benefits of what is learned at the refueling station while allowing the refueling station to determine how its facilities can be used best for different types of vehicles. In this way, the projects will augment each other and provide significantly more useful information than if they were located separately and operated with total independence.

DOE's Efforts Under the Act

To date, DOE has funded only feasibility studies under the Act. As noted above, A.G.A. is aware of no demonstration projects that have been undertaken under the auspices of the Act. Of course, this lack of demonstration projects fails to address the primary impediment to more widespread use of methane fueled vehicles -- the development of a refueling system in concert with a level of demand for fuel that justifies capital investment in refueling stations. The Glickman amendment should provide significant incentives for demonstration projects to fill the void that has existed regarding DOE's implementation of the Act.

Conclusion

A.G.A. commends the Glickman amendment as a valuable tool for focusing on the difficulties that prevent the proliferation of methane vehicles. We recognize that Mr. Glickman has provided, and continues to provide, valuable leadership in fashioning tools for overcoming the institutional barriers to the broad development of methane vehicles. We applaud his efforts. We believe that the amendment's incentives for sponsoring demonstration projects are a significant improvement over the Act. Encouraging the specific types of demonstrations discussed in this statement should open up public and private efforts to employ methane-fueled vehicles in a wide variety of uses.

Mr. GLICKMAN. Thank you very much.

I think we'll go ahead with Dr. Mulvin because I didn't realize the House was going in at 11 instead of 12, so we may be in a little more of a rush today than we thought.

So, we'll proceed with you, Dr. Mulvin.

STATEMENT OF DR. ROBERT D. MULVIN, ADMINISTRATOR, HARBOR CREEK SCHOOL DISTRICT, HARBOR CREEK, PA

Dr. MULVIN. Very good. I'm delighted to have the opportunity to be a part of the governmental process, I guess. A guy from northwestern Pennsylvania doesn't get this kind of opportunity. And it appears, as I look around the room, that two of us from Harbor Creek have made it to this room—Paul Weitz, the Skylab astronaut and also the commander of Challenger is from Harbor Creek, and I spent 3 days last week with Paul. So I guess two of us have been—had the fortunate to come here.

I think there's a couple of things that are important, as I sum up some of the concerns that we've talked about this morning. One of those is that it seems like we're all looking for an immediate alternative for the whole country that we're going to solve all the problems. I would suggest to you that this country has got to have many alternatives to turn to, and there's room for all of us to exist. And there's different functions which they can serve best.

We talk about the problems of maybe the fueling, and so on, with natural gas or—either the methane in the compressed form, like we're using it at Harbor Creek, or the liquid form, like the Beech people are pursuing. I would suggest to you that if you would put the gasoline business under the same kind of scrutiny, you'd probably find more shortcomings. My wife has a car, for example, that runs on gasoline and the catalytic converter, which was supposed to solve all of our problems, got cherry red and caught on fire recently. So it's not to say that the other—the most convenient and most used fuel is not there in terms of the same kinds of concerns.

My experience has not been the same, Mr. McCandless, as yours has. I'm a school superintendent in northwestern Pennsylvania, and I'm one of these fellows that Frank talked about that laid his line on the job [sic], and I literally did that. I said to our board: "I feel strongly enough about this project that, if you'll go along with me, and if something happens it doesn't work, then you can fire me and I'll move on. That'll make everyone feel better." But, obviously, that didn't happen, and we've had a good success. I'd like to take a couple minutes to talk about that success with you.

There are many uses for methane that we've found that, at least in our experience, seem very, very attractive to this country and ought to be considered, and would be certainly attractive to Mexico, also.

One of those is the schoolbus-fleet business. It's unique in that there are hundreds of thousands of schoolbuses in this country, but they all travel a relatively short distance every day. They use a lot of gasoline, and that they all return to the same fueling station each night, so that makes the characteristics that have been summed up as a shortcoming for methane very attractive for this use.

In Harbor Creek we've gone with a total methane project, compressed methane, which we put into application in 1981.

I think where I felt a shortcoming myself and would encourage the committee to continue with some sort of demonstration project, there was nowhere at that time that I could find where I could turn and find out anything about the process. I looked out the school window one day—I have three gas wells on school property that we've drilled for school use, and I don't have a use for that gas literally from April until November—and I looked out the window and all 26 of our school buses were rolling by my window and I said to myself: "Why can't we run those school buses on the natural gas excess that we have?" And, indeed, I started to at that time do some research and found a very limited amount of information available, and had to plow that ground literally myself and ended up taking a trip, partly at my own expense, to your good State of California and visited the dual-fuel people, who at that time appeared to have their act together probably more so than anyone else, at least from my limited research.

Well, either way, after making some stops and some observations, there wasn't any place this side of the Mississippi that was using compressed natural gas to run schoolbuses. I found a small district up in northern Colorado. I visited. They were very happy with their program.

So I returned. We literally sat down and wrote up a set of specs. We were 6 months ahead of the Commonwealth of Pennsylvania. There were no specifications at that time that Pennsylvania even had in place.

So what we did was to look around, and it appeared that the State of California, indeed, had the most strenuous regulations in place already, so we built our spec around their spec, which we couldn't believe that, if they were the best, that anyone was going to exceed that. Well, that worked out very well for us.

Well, what I've tried to do here—and I'll go through it very quickly, because I understand your time schedule—but what I've tried to do is to—is I've been a part of programs around the country; I get many questions. I think maybe I can answer your questions by presenting to you those 15 questions that are most often asked.

Did I look at other alternatives when we went to methane? Yes, we did. We looked very carefully at diesel, and we looked very carefully at propane. We rejected propane on the basis that it just appeared to be a source of energy that was much too dangerous for schoolbus use. You think of a schoolbus—you've got a large apron underneath. Propane is heavier than air. It puddles. You've got an enclosed schoolbus. When it's stored at night, they could also hold this propane, which appeared to be too dangerous for what we wanted to do with it.

We looked at diesel. The additional cost of the diesel engine for a schoolbus, plus the price differential in gasoline and diesel fuel, were not great enough economically, at least our numbers, to justify that transition.

So we elected to go at that time with a compressed natural gas system. We sent our two men—our specifications initially called for two of our mechanics to go to California and be trained after we had a successful bidder. They installed all of the equipment themselves. We have a 40-vehicle fleet in operation which includes 26 or 27 schoolbuses, a 1943 Army truck, pickup trucks, dump trucks, driver education car, and a school car that I use, tractors that mow the lawn. Every vehicle we have is running on compressed natural gas.

We often get questions: Are methane-fueled vehicles more dangerous to operate than gasoline-fueled vehicles? We don't think so. In fact, we think in many ways, according to the data that I've been able to assemble, that they are, indeed, probably much safer.

We took extra precautions. We complied with the best spec that was available in the Nation at that time. We complied with all of the specifications that have been developed by the Department of Transportation. And, in addition to that, every single vehicle that we have we put in what in the gas business I guess they call a sniffer. There must be a more sophisticated name, but it simply sniffs any small level of gas and sounds an alarm for the safety.

We have not had one of those sniffers, incidentally, other than the weekly tests that we put them through, ever go off in the 3 years that we've been in operation.

We are often asked, how do the miles per gallon on gasoline compare with the equivalent volume of methane? And once in a while we all get in arguments over just exactly what amount of cubic feet equal an equivalent gallon, but I'm not going to argue that point. I'm talking about equal parts, the best we can calculate that.

And our experience has been on school buses that we actually get 1 to 1.5 miles per gallon more than we did on gasoline. And the reason for that is the schoolbuses—we underestimated the amount of time that they spend in the idle mode. We stop, we pick up children, they load, they unload. We get to school; we wait. And as a result of that, the efficiency of our fleet has been increased by 1 to 1.5 miles per gallon for every schoolbus that we use.

What was the total cost of our project? Our project cost for the compressors and the stations, the vehicle conversion kits, and the whole business that made it possible was $147,000. We had initially projected a 2.4-year payback on that investment. As it turns out, that payback was in actual fact 1.9 years. So we felt pretty good about that. So that's worked out for us.

What was involved—we're often asked, what's involved in a typical conversion? Well, it—there's not a lot of sophistication involved there. It's simply an adapting kit that goes onto the engine. It takes two men about 7 hours to install one of these on a schoolbus, of which most of the time is spent drilling holes to put up the brackets to hold the tanks.

The beauty of the equipment on schoolbuses and for fleet use for us is that, for example, on the car that I have that is already four-generation equipment. I have had that same equipment on and off of four cars. And so the initial investment is one that has a long life.

I was worried initially about the possibility of a lot of maintenance on this kind of equipment. That has not been a fact at all.

How many years would recover it? I talked about that—1.9.

When operating on methane vehicles, do you experience a loss of power? We are quite often asked that question. Yes, we do experience a loss of power under certain circumstances: Full load, 72 students on the bus, full power, sometimes on a hill, and so on, but that to us was a writeoff. Because of the economy and the dollar savings that I'll talk about in a minute, that didn't seem important to us.

First of all, if you think about it, a schoolbus only operates a full load for a very short period of time. When you're full, you usually start out and you're heading for school, so that the actual startup there is minimal.

What kind of dollar savings does Harbor Creek save annually? I'm talking about a small school district now in northwestern Pennsylvania, 3,000 students. We have a budget of $7 million total budget; 2 or 3 years ago, before we got into this project, 4 or 5 years ago actually, our board sat down and we had to make some gut-level decisions, and I think those decisions are equally important to the Federal Government and every other community and municipality in this country. And those decisions surrounded around the fact that, with declining enrollments and fewer dollars available to us, and the Federal dollars were also shrinking in their projects toward education, how could we fund the district? We felt that we had cut the education program to a bare minimum and we had to stop. Any further cuts would, indeed, jeopardize the educational process of Harbor Creek.

So we looked carefully at our budget, and we found, out of $7 million, we were spending $2.5 million—$2.5 now out of $7—bringing kids to school in the morning, turning the lights on, keeping them warm, feeding them at noon, and taking them home, and we haven't taught anyone a thing.

And we said, as a board, that if we're going to have to deal with cuts, then that's where we're going to deal with those cuts. We're going to deal in that $2.5 million, and that's actually what set the ball moving in this area.

Our savings the very first year of the methane project were $86,000. Now that has since then varied, and it varies with the price of gasoline, and natural gas had an increase and gasoline actually had a decrease for a while. Now I see that gasoline is on the upswing, so possibly this year we'll see a little wider spread.

What has been the public reaction in Harbor Creek to students riding on methane-fueled vehicles? It was very pessimistic at first. Our people were concerned. We had language going around town sort of like, "Our kids are going to be riding on bombs."

And we sat out, probably 6 months before we ever had the project installed, on a massive, inservice training program of everyone in town that would listen. And I spoke at every Rotary Club, and Kiwanis Club, and organization, Sunday school class, in our area. I had many long, tiring sessions with firemen. They were the worst pessimists of all.

As a result of the in-service—we also had the biggest party probably Harbor Creek has ever had. We had a big party, invited 700 people from the community to come to our party, ride on the schoolbus, get under a bus, look at the equipment, listen to it run—all trying to put this aside.

Well, what's happened in a period of 3 years is that pessimism has now turned to optimism, and it's a community pride project. Our people, some of those who opposed the project most strenuously in the beginning, are now leaving Harbor Creek and they're talking about the good things that we're doing, the contribution that little Harbor Creek's making to, in some small way, to the balance of payments, the imported oil, and all the good stuff that you talk about here in Washington. Now that's one small district.

Since we've started the Harbor Creek project, the city of Erie and the Mill Creek School District on the other side of Erie, which is a small district about the same size as Harbor Creek—if you get the picture, Erie's in the middle, and here's two lakefront school districts on each side. Those three school districts this year in Erie County will free up 700,000 to 800,000 gallons of gasoline—three school districts. That's not even Erie County. We have 11 school districts in Erie County.

So I think there's a potential that must be pursued by the Department of Energy and must have the support of the legislature to foster these kinds of projects. Those dollars are there.

We get into other kinds of questions—mechanical types of questions. Do you have cold-weather-starting problems? Absolutely not. You know, the pessimists say: "Yes, we will have." We haven't had. We've had situations where in our area we get 30 to 40 degrees below zero up in northwestern Pennsylvania, and I can tell you that our problems of starting are much fewer than they were on gasoline.

If you think about it, you have busdrivers that would get on in the gasoline on a very cold morning, below zero, and they would pull out the choke, and pump the gas peddle, and the first thing they'd do is flood the engine and it caused a serious problem not only in starting, but you run the battery dead.

Well, these are things that you can read. My answers are there.

Our vehicles are all dual fuel. I don't know, if I were doing it again, I think I would consider, frankly, just converting a fleet to methane. We like the capability of going both ways occasionally for an emergency, when we have a long trip, distance, but I think we could have vehicles specifically for that purpose.

I think that's one of the problems—that we're all trying to put alternatives together that include the use of gasoline right now and make them a dual-operated vehicle.

What kind of a range do we have? Sure, there's limitations with methane that I think you could consider, and that range is, in our case, 60 to 90 miles. But that isn't important for us. We don't go any more than 90 miles. We all return to one spot. We fuel buses on timed fill as well as quick fill. The majority of our fleet is filled on timed fill at night.

We have experienced a lot of savings as a result of, not only in the dollars I talked about above, but other kinds of savings. For example, we put a stopwatch on a fellow just before we started into the program under the old gasoline system, and we were spending 2½ hours a day pumping gasoline. We didn't realize that before. We don't spend any time now with a mechanic pumping gasoline. These are filled on a time fill at night. The bus driver pulls in, hooks up a hose that is not even in the filling process at that time; it's literally what we would call a dead hose at our place. At 9 o'clock at night, when there isn't anyone around, automatically the fill cycle begins. And when all of the buses and vehicles there are filled, they shut down. That's about 2 o'clock in the morning. When they come in in the morning, again, no one's handling any live gas filling hoses or dispensing mechanisms of any kind.

Should all volume users look at methane? No, I don't think—I think that's part of the problem that we're wrestling with here, both the legislature, and the Congress, and the Energy both. We're looking at an alternative for the whole country instantly. I think there are alternatives right now that lend themselves very well. I don't think there's a better one in this country than schoolbuses, but there's also municipalities and there's cab companies, and a lot of vehicles.

For example, right now in the Commonwealth of Pennsylvania, right in Harrisburg, the Commonwealth has 1,500 vehicles that don't leave the city limits of Harrisburg—a beautiful example, I think.

Much of the State police operations are ideal. We have a State police barracks right in the township where I live that has 60 vehicles. Certainly all of those vehicles operate within the acceptable range, distancewise and so on, that would be very adaptable to methane.

Mr. GLICKMAN. Dr. Mulvin, I'm going to have to stop you because we have the second bells of a rollcall vote, and we're going to have to go and vote.

I, being a former president of a school board, I want to know if they raised your salary. I know they didn't fire you, but did they raise your salary after you——

Dr. MULVIN. No; they didn't raise my salary, but what they have done is agreed to permit me time off to go around, without any extra pay, but to go around and tell the good story.

We've had a good experience, Mr. McCandless, and we're delighted to tell that story, and I would welcome the opportunity.

The only thing I would say to you from your committee is I don't think we should get hung up on new kinds of model demonstration projects with new equipment and big dollars expended for that process. I'm saying to you that Harbor Creek's got one in operation. And what you need is a few dollars to send some people out, collect the data, and put it together, and be able to disseminate that information to other people around the country. And we'd be delighted to participate in that process. But you don't need a lot of new, sophisticated processes. There are other kinds of studies, obviously, that need to be done for the technology to move ahead.

Thank you very much. I appreciate the opportunity, and I understand your schedule.

Mr. McCandless. That's why the gentleman retains his job. He's a very practical person.

[The prepared statement of Dr. Mulvin follows:]

Committee on Science and Technology
Subcommittee on Transportation
Hearing Testimony Outline

by

Dr. Robert D. Mulvin
Superintendent of Schools
Harbor Creek School District

Harbor Creek Methane Vehicle Project

Presentation April 26, 1984 9:30 a.m.
Room 2325 - Rayburn House Office Building

With reference to the Harbor Creek School District methane-fueled vehicle project....I have assembled a summary of the 15 most often asked questions about the project with my personal reactions.

1. Before going to methane....Did the Harbor Creek School District examine other fuel alternatives such as propane or diesel?
   a. Yes....we examined both alternatives very carefully and rejected propane on the premise that for school bus use the physical characteristics appeared to be much more difficult to monitor from a safety stand point....diesel fuel was rejected on the basis of a limited cost differential in fuel and the additional cost of the diesel engine.
2. How long has the Harbor Creek School District been operating vehicles on methane fuel?
   a. Since September 1981
3. Are methane fueled vehicles more dangerous to operate than gasoline fueled vehicles?
   a. No....The Harbor Creek System has been installed with absolute adherence to both Federal and State standards to maximize the safety aspects....All vehicles also have a methane gas "sniffer" (not required by regulations) as an additional safety precaution.
4. How do the miles per gallon of gasoline compare with the equivalent volume of methane?
   a. Our records indicate that for school bus use....we actually receive one to one and one-half miles more per equal volume of methane than gasoline. (This situation exists because of the amount of time a school bus spends in the idle mode)....All other vehicles compare favorably between methane and gasoline.
5. What was the total cost of the Harbor Creek Methane fuel project?
   a. $147,000 (compressor station, 40 vehicle conversion kits and both quick-fill and time-fill capability)
6. What is involved in a typical vehicle conversion?
   a. No significant changes in present equipment, but rather the installation of additional tanks, regulators, an air-gas mixer, and fuel gauge. (A typical installation requires a trained mechanic and one helper 7 hours)....The Harbor Creek project bids included two weeks of training for two mechanics. All the equipment for the described project was installed by our trained mechanics during the July and August of 1981.
7. How many years were required to recover the initial cost outlay of the Harbor Creek installation?
   a. One year and nine months

8. When operating on methane do vehicles experience a loss of power?

   a. There is a minimal loss of power under a full-load full-power situation. However, these conditions are minimal and certainly acceptable as a trade-off for the dollar savings.

9. What kind of dollar savings does the Harbor Creek project annually generate?

   a. The annual savings has ranged from $68,000 to 86,000, which does not include many other cost advantages which are surfacing as on-going data is gathered such as: prolonged oil life and spark plug wear and extended engine life.

10. What has been the public reaction to students riding to and from school on methane fueled vehicles?

    a. Initially....pessimistic - however with extensive inservice, community public-relations and 100% safety record it is now optimistic, in fact, a community pride project.

11. Have you experienced any cold weather problems such as "freeze-ups"?

    a. No....Actually the cold weather starting of our school busses has been enhanced with the use of methane.

12. Are the converted vehicles still able to operate on gasoline?

    a. Yes....All vehicles in our fleet are duel fuel conversions, however, for school use vehicles only carry a minimal amount of gasoline for extended trips and emergency operation.

13. What is the range a school bus can travel on a "normal" school bus conversion?

    a. 60 to 90 miles depending on the number of storage cylinders, however this could be extended by the addition of more cylinders.

14. Should all volume fuel users consider a vehicle methane system?

    a. Compressed methane systems NO....Compressed gas appears to be most adaptable to fleet operations requiring more than 150 gallons of fuel per day and vehicles with a limited daily range of 100-150 miles while returning to a common fueling station daily.

       Liquid methane systems YES....At the present time there are limited fueling stations for liquid methane, however the potential for over-the-road vehicles and long distance look very attractive for the future.

15. Should the United States be developing public fueling stations?

    a. Yes....There is a tremendous potential for methane (both CNG and LNG) in this country, which would greatly reduce our dependence on foreign oil imports, while at the same time providing a clean and efficient energy resource for many years in the future.

Mr. Glickman. We're going to have to adjourn for a moment. So, in order to deal with the time of the next witness, I want to thank both the witnesses. I think we'll—unless you want to come back and ask them any questions, Mr. McCandless.

Mr. McCandless. Just very quickly, what does Ford consider to be the difference in its consumer cost between the methanol- or methane-fueled vehicle versus the conventional one, if they were to go online with such an option? Have they talked to you about that?

Mr. Jeffrey. How much more would they charge for a comparable vehicle if it were totally dedicated to natural gas?

Mr. McCandless. Yes.

Mr. Jeffrey. About $900.

Mr. Glickman. Thank you very much.

We'll be back.

[Recess.]

Mr. McCandless. I'd like to ask some questions.

Mr. Glickman. OK. Well, do you want to keep—I'll tell you what, our two folks that were just here, Mr. Jeffrey and Dr. Mulvin—is Mr. Jeffrey still here or did he leave?

A Voice From the Audience. He left.

Mr. Glickman. He left. OK.

Dr. Mulvin, I think that—why don't you come back? Mr. McCandless is going to take over the chair in a moment, and he has, I think, a couple of questions for you before we go to our last panel.

Mr. McCandless. Well, I appreciated the frankness and candidness with which you addressed this. It's refreshing, and particularly in this town, if I may say so.

I would just add one thing so that we have something in common. I used to sell schoolbuses and deal with superintendents of schools and school boards, and all that other good stuff that goes along with it, including the manager and foreman of maintenance.

The question that I had interest in was, you described your activity very well. And this is maybe a little off, but you said you had three wells out in the front yard. Were you utilizing that resource or did you sell that off to somebody and buy something in exchange?

Dr. Mulvin. No; we utilized that full resource of the wells, not only for fueling the buses, but for heating the building.

And I was interested in your earlier questions regarding the possible contaminants that you would find possibly in well gas, and so on, and how those are treated, and so on.

There are ways to treat those, much the same as with other kinds of fuels there are contaminants that must be treated. We have some sulfur dioxides, and so on, sulfates that need to be treated, but we've got filters on the wells that handle those.

We have some moisture, and that moisture goes through a dryer before it ever goes into the compressor. So those kinds of things can be treated effectively and very inexpensively.

For example, the dryer that is on our—precedes our compressors is about a $1,500 piece of equipment. So it's not an expensive process to deal with some of those concerns that you have.

But your pessimism in the beginning concerned me, because ours has been exactly the opposite. It has run very, very well. We have not had or experienced in 3 years any major problem whatsoever in any phase of the operation, from fueling to running the buses.

Mr. McCandless. Well, I think that speaks very highly for your organization.

My experience was a 300-fleet county operation, and just about everything in the 7 years that we had them that could happen happened, including blowing up, killing people, and that kind of thing—probably due to the carelessness of the individual, but that all, in the sum total of it, developed experience.

The problem of refueling was acute. The distance—a lot of these traveled 200 miles one way to the other end of the county for purposes of delivery, conveyance, people, so on and so forth.

The mechanical aspects of it—failure of equipment to function; the failure of the engine at a premature time with the manufacturer disclaiming any liability because of the conversion. He said that's what caused it—burning of valves at 6,000 miles, and that kind of thing.

It was just a storybook of everything to do—everything that could happen and the reasons why not to get involved in the program.

And the whole idea was that the Los Angeles Basin had an acute air-emission problem, and so everybody was seeking an answer to alternate fuels for that purpose, not necessarily the cost or economy of a fleet operation.

I'm going to take the time to mention that because you kind of asked me what was my experience.

Dr. Mulvin. Well, see, ours really has been almost the opposite. I've got in my briefcase—maybe, Roy, you can open it up there and circulate it across the counter.

Mr. McCandless. Let me say this: I can see that school district and I can see that bus barn and I can see every tool in place, and nothing on the floor after you've got done doing something, and people who pay attention to the type of work that they're hired to perform in that bus barn. And I have to tell you that's 75 percent of the situation in your favor.

When you have people who are dealing with all kinds of equipment, and you've got a sheriff's car in there one minute and you've got somebody else in the next minute, and one is gas and one isn't, one is propane and one isn't, and you're trying all kinds of things, that's not conducive to the maintenance tranquility that is necessary to operate these things. And so that was one of our problems, also.

Dr. Mulvin. See, we started out right from a gut level to make it work. We were convinced that it could work, and we started out with tremendous in-service—I talked about that big party at Harbor Creek. Do you know who the tour guides were that told everyone how it worked? They were our school bus drivers and our mechanics.

Mr. McCandless. Sure.

Dr. Mulvin. In terms of—you know, you mentioned your concern about the age of the vehicles, and so on, in Mexico—and that's an obvious observation. But I would suggest to you, if you get beyond the initial startup, the kinds of things that you'll experience from methane are—for example, our schoolbuses right now go through a routine overhaul of the engine on gasoline, they did when we were using gasoline, at about 75,000. We now have schoolbuses with 96,000 and 97,000 miles on them that are still running very, very well.

And my good friends in New Zealand tell me that we can expect to get about 135,000 to 140,000 miles on a schoolbus without an overhaul. So, once you get by the initial installation in a place like Mexico, I think that the prolonged longevity of that engine, because of the way that they use their vehicles, will be an important part of that process.

Here's a spark plug, and I'll just circulate this when I sit down for you to take a look at. It's out of a van. One of the mechanics sent it to me 2 weeks ago. It says: "This spark plug has 58,807 miles." Now with a schoolbus before we changed spark plugs every 4,000 miles. We've got vehicles with 48,000 and 47,000 miles on them right now that we have not changed the oil. We've added oil in the process. We have taken every 5,000 miles the oil and sent it in to Mobil, who has been willing to work with us on the testing process. So, there are things like this that we haven't built into the savings that we have a good feeling about.

So I don't—I don't have any motive at all. I don't represent the gas association or anyone else. I'm just happy about what's happened and feel good about it.

Mr. McCandless. I guess the only thing that I would conclude with—and I certainly applaud you for this—is, after all that effort on the part of the county of Riverside, and at that time I happened to be one of the governing body, the tailpipe emissions, as taken by instruments in the field after the cars were operated, were not that much different than the cars that were operating on conventional gasoline. So, we went through this pony-and-dog-show gyration and didn't really accomplish an awful lot with a tremendous amount of additional expense, and it was somewhat disheartening because we had anticipated some benefits that were not forthcoming.

You don't have an emission problem in Pennsylvania where you are, I assume, and that was the motivating factor in the whole program that we got involved in.

I don't want to belabor the issue.

Thank you, Mr. Chairman.

I appreciate your sharing your thoughts with me.

Dr. Mulvin. I appreciate the opportunity.

Mr. Glickman. We thank you for your testimony in that you give some institutional credibility to the concept of methane or natural gas as a motor fuel, and that it does work in a practical context. We appreciate your suggestions.

Thank you. Thank you very much.

Dr. Mulvin. Thank you very much.

Mr. Glickman. Our last panel today is Mr. William Kramer, applications engineer, NGV Division, Washington Gas Light Co., Springfield, VA; accompanied by Mr. Paul Hathaway, the senior vice president, operations, Northwest Natural Gas Co., Portland, OR.

We appreciate your both being here today.

I understand, Mr. Kramer, you have the prepared statement. Mr. Hathaway, you don't have a prepared statement?

STATEMENT OF PAUL HATHAWAY, SENIOR VICE PRESIDENT, OPERATIONS, NORTHWEST NATURAL GAS CO., PORTLAND, OR

Mr. Hathaway. No; I'm prepared to make an informal statement.

Mr. Glickman. An informal statement. So why don't we start with you?

I apologize; I'm going to have to leave now, but Mr. McCandless will take over the Chair. And I want to state for the record that these hearings may produce some legislation modifying the methane bill which is currently on the books, and so your testimony will be very important to us.

You may proceed.

Mr. Hathaway. Thank you very much, Mr. Chairman.

My name is Paul Hathaway. I'm a senior vice president, operations, for the Northwest Natural Gas Co. in Portland, OR.

My experience with methane vehicles goes back quite a ways, to about 1966. In those days I worked with San Diego Gas and Electric Co., in charge of their gas operations, and we built the first LNG vehicle, I think in the country, and maybe one of the first methane vehicles in the country, and did a fair amount of experimentation with it.

I had to almost stand up and cheer Dr. Mulvin because we went through the same kind of gyrations—educating people about liquefied natural gas in general and LNG vehicles later on at a great many Rotary Clubs and other organizations, and with much the same kind of result—that once people were educated as to the values and benefits of liquefied natural gas, they became very supportive of it.

I think it worthwhile, too, particularly in light of the bad experience that you seem to have had, Mr. McCandless, to talk a little bit about the history of development that went on in those years.

The vehicle conversion, the first one, as you might imagine, was done in a very simple way. We took a propane carburetor and drilled it out to accommodate methane, and put a copper coil behind the fan and the radiator to be a vaporizer for the liquid, and found a 40-gallon, standard, liquid nitrogen tank that was strapped in the back of a pickup truck, and that was the first LNG vehicle, and it ran very well. We didn't know much about it.

And we wound up taking it ultimately to Los Angeles for some tests. Now the first place was the Automobile Club—was the only one that had a laboratory at that time, and later on the Los Angeles Air Pollution Control District, to test the emissions.

The whole trust of the program then was emissions, the reduction of air pollution, particularly prevalent in the southern California area.

We ran a 50,000-mile test of the two vehicles with the Los Angeles Air Pollution Control District in the following year, first on gasoline and then a comparison test over 50,000 miles to see if there was a degradation of emissions in the vehicles over time. We found there was not.

These early tests showed that the vehicles running on methane could equal at that time, with virtually no engine modification at all, the standards that were being talked about, proposed at the Federal level, for the middle 1980's.

We did engine tests on the vehicles. We varied valve timing. We varied compression ratios. We varied spark timing. There was a tremendous amount of very practical type of testing—do it and see what happens.

We found that it was possible to control emissions on the vehicles very closely. It took us a while to find that out—that the worst of those to control was the oxides of nitrogen emissions. We found that if you essentially derated an engine to a relatively low compression ratio and set the timing a little slower for the slower burning characteristic of methane, and leaned out the air-fuel ratio to a much greater degree than was possible with a liquid fuel, that you could achieve a very significant reduction in oxides of nitrogen as well.

There was, of course, a tradeoff there. As you did that, your engine performance suffered. So you probably would—we were at about an 80-percent performance for the engine. But that was the point of where the emission levels were the lowest.

We were interested, too—I was intrigued by your commentary on aircraft use. We did some work with NASA in those years when they were thinking of LNG as the logical fuel for the American SST, and they figured there would be, I think, a 30-percent increase in the volume requirement to store the fuel on the aircraft but a 20-percent savings overall in the load-carrying ability.

And we did some gun fire tests in about 1968 or 1969 with that same thing in mind, of if it's going to be a good aircraft, it will probably be a very good helicopter fuel because of that lightness characteristic.

So we dragged some tanks up to Camp Pendleton and got ourselves a Marine gunnery sergeant to fire tracers at LNG tanks, and at jet fuel tanks, and gasoline tanks, and found, as you might suspect, it was very difficult to ignite the LNG in comparison with the other fuels, simply because of their chemical characteristics.

It was kind like going back in time to hear some of the earlier comments of things that they're looking at now.

I think our assessment in the last analysis, in working on LNG vehicles at San Diego—over a good many years we converted several fleets, a State highway fleet, a bus fleet, in this case the San Diego Zoo buses, our own fleet of service vehicles, perhaps 50 of them at one time. Eventually we worked with the GSA and had LNG fleets in the National Park Service in Yosemite and Sequoia National Parks for a few years.

We did not experience the very bad-sounding maintenance problems that you mentioned. There were problems, to be sure, and there was an education problem primarily of the people that worked on the vehicles to, first, note the difference and become used to handling a different fuel, but, essentially, insofar as the vehicle engines were concerned, not a great deal of difficulty with them.

Our thrust in those days, because the cost of fuel was really about equal, our thrust then was to seek a lower emission type of vehicle. As the cost of fuel went up, and in the middle seventies when natural gas was in short supply, the interest waned in the project pretty well nationwide, both in LNG and CNG vehicles. And I think that's why it hasn't gotten any further than it has, except in some isolated instances where you've had a champion like Dr. Mulvin who believes in it and has pushed it.

I think that the technical work that's been done is adequate. I really don't see a great need for more and more emissions tests and more and more similar types of basic testing on will the system work. We know the system will work. We know that you can achieve a significant reduction in emissions with it.

The problem that I see that remains is the cost problem.

In my company now, in Northwest Natural Gas, we have two fleets running on methane, one on CNG, and one on LNG, 50 vehicles on CNG and another 25 on liquefied natural gas.

The work that we've done indicates there that, as far as the fuel cost goes, the CNG is a cent or two a gallon equivalent cheaper perhaps, in the 40 to 45 cents per gallon equivalent cost of just the fuel.

The liquefied natural gas, because of the technology needed to reach the low temperature and liquefy the product, we've figured at about 52 cents a gallon.

So for operating costs, purely considering fuel, there's obviously an advantage to methane. The problem lies in amortizing the cost of the vehicle conversion.

I understand now that Ford Motor Co. has come out with a dedicated methane vehicle, a CNG vehicle. They are estimating the cost of—the added cost of that vehicle—at around $900. That's my understanding.

We find in doing a conversion, a CNG conversion costs around $1,200 a vehicle, can be shifted from one vehicle to another, so you can amortize it over a longer period of time, and LNG, a little bit more costly because of the higher technology of the storage tank, perhaps $1,500, $1,600 per vehicle for LNG.

If you run that out very grossly into a cost per mile, it comes out to slightly above the cost per mile for gasoline, and that's why currently the development of the methane-fueled vehicles has not proceeded apace, because the operators now have to look very hard at the cost of fuel, the cost of operating the vehicle, rather than the more elegant approach toward reducing emissions in the area. If you're a typical fleet operator, I think you have to look at your bottom line first.

So, the development that I see that's really needed, and we do support, and very strongly support, the Glickman amendment—I would suggest, though, that we need to aim the demonstration projects at perhaps a more practical level, perhaps at educating the public in some of the experiences that have already been had on a practical level.

We do need to develop less costly vehicle conversion systems and less costly fuel-dispensing systems so that methane does become a competitive factor in the vehicle fuel market.

I would suggest, too, for the committee, if they're interested, that there are a number of other gas distribution companies around the country and around the world who have had extensive experience with both CMG and LNG methane vehicles. One that comes to mind is NSTAR, a natural gas company in Anchorage, who have done an enormous amount of work in CNG vehicles, including, I might add, a fleet of schoolbuses. They have operated what amounts to a public filling station in Anchorage for the last couple of years. It isn't really public. It's a key operation, and they have a dozen or so fleet users who have their own key and their drivers come in with the key and to tie the filling operation into their particular account on the computer and fill their own vehicles. They have even done some home filling stations, a small compressor, at the homes of several of their executives, that's operated very successfully. And this operation of theirs has been going on for several years. Their entire fleet is operated on CNG, and in a very hostile climate, if I can characterize Anchorage that way, a very difficult climate to operate a vehicle in. They have had very good success with it.

Obviously, Southern California Gas Co., with their extensive experience, you already know about.

I would suggest to you, also, that around the world methane is a fairly common fuel in some countries. In Italy, I think, there are more than 600,000 vehicles operating on methane. New Zealand, as I'm sure you're aware, has an extensive conversion program to take advantage of their natural gas resource.

While I don't recommend it, I know that the Canadian Government is very strongly subsidizing the use of methane fuels all across Canada.

There's a place in our country, I think, for CNG, LNG fuel. I think we need to develop alternates for transportation fuels of every kind.

It's better, in my view, to do what we can on using our domestically available fuels, our abundant natural gas, to offset some of our dependence on foreign oil imports.

And I think we have in the methane transportation system in this country, the million miles of pipeline that we have, the ability to distribute that natural gas throughout the country as well as we distribute gasoline and oil products today.

So, I would offer my thanks to the committee for the continuing push to develop this alternative.

I thank you very much for the opportunity to testify before you.

Mr. McCandless [acting chairman]. Thank you, Mr. Hathaway.

Mr. Kramer, do you have anything you wish to add?

STATEMENT OF WILLIAM A. KRAMER, APPLICATIONS ENGINEER, NGV DIVISION, WASHINGTON GAS LIGHT CO., SPRINGFIELD, VA.

Mr. Kramer. Certainly, I do.

I'm Bill Kramer, an applications engineer in the natural gas vehicle division for Washington Gas. Washington Gas has had a natural gas vehicle program in operation since 1980, and we certainly welcome the opportunity to share some of those experiences with you.

I'm not going to take a lot of time to discuss the benefits that have been detailed about natural gas vehicles. Just briefly touching on them, primarily the fuel savings that can be realized, utilizing natural gas versus gasoline, reduced emissions, the improved engine performance and reduced maintenance requirements that can be achieved, and also the safety factors involved.

It is the fuel savings aspect of the utilization of natural gas that has caused Washington Gas to get involved in the program. We have approximately 150 vehicles converted to natural gas, with plans for continued expansion.

And we have just recently gone to the market to develop the idea of the public—large fleets utilizing natural gas.

We have experienced a number of difficulties in doing so. Some of these have been related by Mr. McCandless and others, and I'd like to spend a few moments touching on those.

As much information as is available concerning natural gas vehicles and their performance, we still find that there is considerable lack of awareness and understanding in general of the NVG concept. Even those fleet managers that are intimately aware of the general esoteric levels of performance, they still don't quite understand necessarily, can this be of economic benefit to me? I recognize that I have a large capital investment required not only in the conversion of the vehicles, but in the construction of a fueling station. So how do I reconcile these problems with the supposed benefits that can be realized from utilizing the fuel?

Another problem that we run into is the lack of a postconversion support network or a supporting infrastructure. Again, the system is only as good as it is maintained, and the most highly designed, technological advanced system can be put in and, without proper maintenance and service, in time that system is going to deteriorate, which I believe you found to be a part of the problem in some of your instances.

Another consideration is the lack of standard, good levels of data that show beyond a shadow of a doubt the way a vehicle can perform, what levels of performance can be expected, the equivalency between natural gas and gasoline, the engine emissions, and, most importantly, the high first cost of the refueling station.

To date, the only feasible case of implementing this program is for the fleet that has a sufficiently large consumption profile that the cost of the fueling station can be amortized over the number of vehicles and the savings that can be generated from utilizing the lower cost fuel.

We at Washington Gas have a number of possible solutions that we are considering to these NVG difficulties, and we have implemented a marketing program trying to address these difficulties.

The first aspect of that program is to continue educating the public by seminars and disseminating written information. We are participating in the AGA-Alcoa "Rally for Fuel Savings," which kicks off here in Washington in September, I believe it is, just to keep the public aware and informed as to the advancements in the technology in the industry as a whole.

More importantly than that, we're attempting to develop a very attractive economic package that allows the prospective fleet customer to work their way into this program without necessarily having to experience a large capital investment; and, also, once that investment is made, some method of insuring that that fuel pricing differential between natural gas and gasoline will be present long enough for the customer to realize his investment.

There are two main items of that attractive package that we're trying to propose. No. 1, we're working on the acceptance of a special rate for natural gas. Ideally, we hope to index that to the price of gasoline, so that a margin can be maintained, and we hope to also index that to the particular economics of each potential conversion. So that the rate may differ if we're talking about a large fleet with high consumption and a fleet that perhaps has fewer vehicles and fewer consumption, smaller consumption level as well.

The other aspect of that program is to provide some type of attractive financing plan, again so the high first cost of the fueling station can be spread out over the term of the program.

In addition to the educational procedure and the financing and special rate, Washington Gas is also involved in the establishment of some type of postconversion support network. At this time that consists primarily in the training of not only the operation of the vehicles, but the training in the service and maintenance of the compressor station, the fueling station, and the vehicle conversion equipment itself.

We'd like to stress that we believe that the utility involvement in promoting this industry is critical and key, as well as the continued research and development efforts from manufacturing companies involved in the actual production of equipment, major industry participants such as Alcoa and Ford, and also we see a key role for the Government to possibly participate in the idea of establishing that infrastructure necessary to make this program available not only to the large fleet user with the high-consumption profile, but to the smaller fleet user and ultimately the general public.

In conclusion, I'd like to say that we're very supportive of the amendment. And, again, we would like to offer some direction to the committee that we believe the thrust of the amendment should come from the establishment of the infrastructure and the increased public awareness of the benefits of natural gas vehicles.

Demonstration projects such as the centralized refueling station concept not only would yield additional data concerning emissions, vehicle performance, et cetera, but would help to eliminate the uncertainty as to how do these vehicles really perform. And in the long range, again, it promotes the goal of energy independence and reduces the overall environmental pollution problem.

At this time I would like to take any questions that you may have.

[The prepared statement of William A. Kramer follows:]

WASHINGTON GAS LIGHT COMPANY
STATEMENT ON
PROPOSED AMENDMENTS TO THE METHANE TRANSPORTATION RESEARCH, DEVELOPMENT, AND DEMONSTRATION ACT OF 1980
BEFORE THE
U.S. HOUSE OF REPRESENTATIVES
SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS
APRIL 26, 1984

Washington Gas Light Company is a mid-size gas distribution company serving approximately 600,000 customers in the Washington metropolitan area. Over 90% of our customer load is residential, with almost 10% commercial and slightly less than 1% in the industrial category.

The company has had a natural gas vehicle (NGV) program in operation since September 1980. We appreciate the opportunity to testify about our experience with NGVs and hope it will provide a helpful perspective on the proposed Methane Transportation Act Amendments.

INTRODUCTION

There is an ongoing need to develop alternate fuel technologies for transportation systems. The nation's goal of energy independence leads inevitably to a search for alternative fuels which can be produced from domestic resources in large quantities. Extensive foreign and domestic use has shown that natural gas can be used effectively as a fuel for automotive engines. Natural gas is currently available in huge quantities and is efficiently distributed nationwide through a million-mile pipe network. It clearly warrants serious consideration for a wider role as an automotive fuel.

In the United States, the use of natural gas as an automotive fuel has been primarily limited to fleets of vehicles. There are approximately 25,000 fleet vehicles presently operating on natural gas, and interest in NGVs among U.S. companies is growing rapidly. This is primarily due to the fact that available data from companies such as Washington Gas indicates numerous operating advantages of a natural gas vehicle as opposed to a conventional vehicle. Some of these advantages are:

- Greatly reduced fuel costs
- Cleaner fuel burn with virtually no air pollution
- Extended engine lifetime
- Improved engine performance
- Reduced engine and associated parts maintenance
- Fewer oil changes
- Easier engine starting in hot or cold weather
- Reduced fuel pilferage
- Safety

Of these advantages, the most important factor to the potential fleet customer is the economic benefit derived from greatly reduced fuel costs and reduced maintenance. For fleets with a sufficiently large fuel consumption, this economic savings can more than offset the capital requirement of the natural gas conversion equipment and refueling station.

WASHINGTON GAS' EXPERIENCE WITH NATURAL GAS VEHICLES

Washington Gas initiated its natural gas vehicle program in September 1980. At that time, fifty vehicles were converted to dual-fuel capability and a refueling facility was installed at our Springfield Operations Center. In April 1981, an additional natural gas refueling station was installed at the company's Southeast Station facility. We have a third refueling station planned for 1984, which will be located at the Northwest Station in Rockville.

As of December 1983, the company had 144 vehicles operating on natural gas. The fleet includes 5 cars, 131 vans (6,000 GVW), 1 truck (20,000 GVW) and 7 trucks (24,000 GVW). Our experience with NGVs has been very positive and the company is committed to a program of gradually converting most of its fleet. In addition, we are hoping to soon offer employees a plan for converting their personal cars to burn natural gas.

Washington Gas has been marketing natural gas vehicles to potential fleet customers for slightly over one year. Test facilities have been installed at two locations. Seven vehicles, which refuel at Washington Gas' Southeast Station, were converted for a county government agency. Four vehicles were converted and a test compressor was installed at the other location, a large university. In each case, follow-up proposals to convert a large portion of the vehicle fleet have been presented. Including these two proposals, the company has made proposal presentations to ten customers, including institutions, local and federal governments, and private industry.

Washington Gas is continually canvassing potential candidates for natural gas conversion. The company is very active in soliciting interest in NGVs, and has taken a pro-active stance on the marketing and support of NGV systems. However, the industry is not without problems, and thus the marketing of NGVs is a difficult proposition. Some of these industry-wide problems and difficulties experienced by Washington Gas are described below.

DIFFICULTIES WITH THE NATURAL GAS VEHICLE INDUSTRY

The following difficulties have emerged since Washington Gas and others began marketing natural gas vehicles to potential fleet customers. For the most part, they are common to the entire industry; that is, if a problem is encountered in one particular marketplace, it is quite likely that the same or a similar type of problem will be encountered in other areas of the country. These obstacles, incidentally, are similar to the ones which have been cited by several DOE feasibility studies conducted pursuant to this legislation.

- Insufficient awareness and understanding of the NGV concept. In many cases, the natural gas vehicle is a completely new concept to even the most informed fleet manager. Those who are aware of NGVs often have misunderstandings as to the performance or safety of natural gas vehicles.
- Economic uncertainties concerning NGVs. In most cases, the decision to convert a fleet to natural gas involves a large initial capital investment for vehicle conversion and refueling equipment. Recovery of that investment is

dependent upon savings generated from the displacement of gasoline by a cheaper fuel, natural gas. Uncertainties about the performance of an NGV, and whether or not savings will truly be generated, as well as uncertainties about the stability of natural gas prices and their relationship to gasoline prices make the decision process extremely difficult.

- Insufficient post-conversion support. Once a fleet has been converted to natural gas, it is extremely important that proper servicing of the vehicles and the refueling station takes place. Unfortunately, with the exception of those rare cases where the user develops his own NGV expertise, this required service and maintenance is woefully lacking. As a result, optimum performance of the NGV fleet cannot be achieved, and the economic benefits of NGV conversion can be severely dampened.

These three problems represent the major barriers to the marketing and adoption of NGV systems on a grand scale. Listed below are a number of difficulties of lesser scope but still of principal concern that go into the formation of the three major stumbling blocks.

- Insufficient data. Although the data that is available does give some positive indication of the performance of NGVs, a more extensive data base would eliminate many of the uncertainties concerning natural gas vehicles. One area in particular is the disagreement over the relation between gasoline and an equivalent amount of natural gas required to obtain the same level of performance.

- High first cost of refueling stations. The natural gas refueling station cost can account for as much as 75% of the overall conversion cost. This high first cost often makes fleet conversion unattractive, regardless of the anticipated fuel cost savings.
- Absence of a national standard. The lack of a national standard of NGV equipment makes it very difficult to state any generic facts concerning the operation and maintenance of NGVs.

POSSIBLE SOLUTIONS TO NGV INDUSTRY DIFFICULTIES

The foregoing questions concerning the natural gas vehicle industry pose difficult, but not unsolvable problems in the quest to increase NGV acceptance and penetrate the potential marketplace. Constant research and development by NGV manufacturers to improve the technology and strong utility commitment to develop the market are both necessary. Government can also play a vital role by funding NGV demonstration projects as provided for in the Methane Transportation Act. Such pilot programs, together with support from the manufacturers and utilities, would go a long way towards developing the understanding and infrastructure necessary to establish natural gas vehicles as a viable alternative for fleets and eventually for private vehicles as well.

For its part, Washington Gas has designed a new marketing approach for natural gas vehicles, which addresses the industry's difficulties by providing three critical elements: increased NGV awareness and understanding, an attractive economic package, and post-conversion follow-up and support. A brief discussion of our approach to solutions may be of interest to the subcommittee.

- NGV awareness and understanding. Washington Gas has held a number of educational seminars to enhance the potential fleet customer's awareness and understanding of natural gas vehicle systems. In addition, pamphlets, flyers, brochures, and other relevant information are regularly disseminated to the marketplace. The company has plans to host an in-depth training seminar in conjunction with NGV equipment manufacturers in the Spring of 1984. This seminar should be an ideal method to help customers develop NGV expertise, as well as promoting interest in the upcoming AGA/ALCOA NGV rally to be held in the Fall of 1984.
- NGV economics. Because the high first cost of converting to NGVs is a major difficulty, providing an attractive economic package is the core of the Washington Gas' NGV marketing approach. There are two primary elements of the economic package which the company is in the process of developing. First, Washington Gas is investigating a special CNG rate. This rate would be indexed to gasoline prices and vary as gasoline prices vary. It is designed to provide a customer with a guaranteed payback of a certain length, preferably two-and-one-half years. The other element of our proposed economic package is a very attractive financing plan. This plan offers a customer the option of financing the purchase

of the NGV system -- including vehicle conversion equipment and refueling station -- over a five-year period at terms that are usually superior to what the customer could obtain independently.

- Post-conversion follow-up and support. Washington Gas is considering several factors in providing NGV post-conversion follow-up and support to potential customers. First, training on the maintenance of vehicle conversion kits and the compressor station would be provided if the customer desires to maintain the equipment. Second, training on the nuances of operation of an NGV is provided to the customer's designated vehicle operators. Third, Washington Gas plans to offer customers the opportunity to take advantage of the company's level of experience with NGV systems by providing assistance with the servicing and maintenance of compression and vehicle conversion equipment.

CONCLUSION

As you can see, Washington Gas is "bullish" on natural gas vehicles. However, the utility industry can not go it alone. Fleet operators are extremely cautious about the economics of converting to dual-fuel capability. For instance, many of them are too small to consider building a refueling station, which can account for 75% of the conversion costs, and would need some type of centralized or public facility. The existence of such a facility would remove a large part of the financial barrier and encourage more potential small fleet customers to risk conversion. This type of project, for which it would be hard to obtain traditional financing, might lend itself very well to a federal demonstration grant or loan.

A series of demonstration projects would advance the NGV industry in many ways.

- Demonstration projects could help to develop the infrastructure necessary to provide post-conversion support.
- The results of NGV demonstration projects would yield additional data that would help to eliminate uncertainties about emissions or the relation between gasoline and an equivalent amount of natural gas required to obtain the same performance.
- Increasing the number of natural gas vehicles and the supporting infrastructure will help the country to achieve energy independence and to reduce environmental pollution.
- Federally sponsored demonstrations would receive national exposure, increasing public recognition and acceptance of the many benefits of NGVs.

Washington Gas wholeheartedly supports full implementation of the Methane Transportation Act and the intent of these amendments. However, we would recommend that the legislation not limit the majority of demonstration projects to emissions programs. From almost four years of experience, we are convinced that the major barriers to widespread adoption lie in uncertainties about the economics of NGVs and the lack of an infrastructure. Thus it would be important to have more than just one demonstration project geared to the development of refueling mechanisms. These projects would have double benefits -- reducing initial start-up costs and developing infrastructure at the same time.

In conclusion, Washington Gas encourages the subcommittee to give the amendments a favorable report. The NGV industry is well established; the pipeline distribution infrastructure is already in place; the technology is proven, yet improving all the time; and the gas utilities are gearing up to do their part. The time for demonstrating that natural gas vehicles can make a signficant contribution to our national transportation system is now.

Mr. McCANDLESS. Thank you.

For the benefit of those who are here, this is all transcribed, and many of the members of the committee will be reading this. So I hope that you feel that your trip here is not lost because you have one Californian left to talk to who has tended to be negative from time to time.

Mr. Hathaway, your project at San Diego Gas was that grandfather one that kind of got the thing going. The Los Angeles Air Pollution District became the South Coast Air Quality Management District, and everybody got on the bandwagon because they said this was going to be a real possible answer to the emissions problem in that basin. And from that has come Riverside County's experience that I've talked too much about, anyhow.

And then you talked about these other programs that were implemented: the Federal program at Yosemite. And you touched very briefly on the fact that, once gasoline became plentiful again and the price went down, the interest seemed to wane.

There's a little confusion here. If we have already invested our money, and if the cars are producing what we have been told they produce in the way of additional economies as far as the life expectancy of the engine and fuel price differential, and so forth—take a couple of the cases here of, say, the Federal agency in Yosemite, or something like that. Why hasn't that continued in the manner in which it was originally set up?

Mr. HATHAWAY. I can't answer that other than to say that the funding dried up for it. The emphasis on natural gas was certainly—well, the emphasis was certainly away from using natural gas or anything but what were deemed by the Federal Power Commission, later FERC, to be the highest priority uses, which were the residential, small commercial, more traditional gas customer uses, and there was certainly not an emphasis on developing a new market in the vehicle fuel market for natural gas during those years.

Had it been otherwise, had there been—I guess I could go into the whole story of what happened to natural gas pricing and deregulation and why we ran short in the middle seventies, but—if you want—but, nonetheless, it happened, and I think that was the primary reason why there was a great decrease in emphasis on the possibility of methane as a transportation fuel in those years.

Mr. McCANDLESS. The idea of liquefied natural gas coming to California and the United States from Indonesia and being put into pipes, and that kind of thing, is that what you mean by the shortage aspect of it? Because all of the testimony currently is that we have tremendous surpluses far beyond that of oil reserves.

Mr. **Hathaway**. That's right, but in the middle seventies you wouldn't have gotten people to believe that. We in the gas business believe that very strongly, but because we had held the price of gas so low for so long by regulation at the Federal level, we had decreased the amount of exploration done domestically just drastically, culminating in the first real sign of the shortage about 1968, and really getting into a significant problem in the middle 1970's.

Then when the Natural Gas Policy Act was put in place, the price of natural gas that a producer could get for his risk was increased enough to make it worthwhile. The producers did, then, go out and explore and did find the additional reserves that we felt were there all along, and now we find ourselves at the other end of the scale in somewhat of a surplus position.

But in the middle years, between, oh, about 1970 to—and most strongly in 1975—we were doing everything that we could to diminish the use of natural gas, to conserve what was then believed to be a diminishing, short-term limited supply of natural gas in this country. So there was absolutely no push at all to look for any kind of a new market or even to take advantage of what natural gas could do in the vehicle field.

Mr. **McCandless**. Mr. Kramer, Congressman Glickman's amendment deals with additional demonstrations with respect to emissions, methane-fueled vehicles, and a refueling station. What can we—you're a supporter of this, as Mr. Hathaway, and your testimony. What can we learn from additional demonstration projects, even though they're part of the law in place, that we don't already have in the way of information from the experience that we've had in the past? Where are we going to gain additional experience in these demonstration projects?

Mr. **Kramer**. I think it's a twofold issue, not only in terms of gaining additional information, but—and I'll come back to that momentarily—what I see as the principal thrust of the demonstration effort is to show that if the infrastructure is in place, then the economics to the individual user and/or the small fleet user will be sufficiently attractive that natural gas can be utilized by that particular individual.

To date, as I said earlier, that isn't true, because in many cases the largest part of the conversion cost is in the refueling station. There is no method for the small fleet of 10 vehicles or less or the individual vehicle owner to access fuel without either building a home refueling station or building his own refueling station.

What I see for the demonstration program is a method to show that a centralized refueling station with service people and mechanics can support a number of privately owned vehicles coming into it, refueling, utilizing natural gas, obtaining the energy savings therein, and amortizing their cost of the conversion of their own vehicles such that it's an attractive program for them.

As far as the information aspect is concerned, even though there has been considerable number of vehicles run, there hasn't really been an active program to ascertain just how well do these vehicles perform, how well do the various manufacturing companies' equipment perform. Again, the technology is as varied as the number of manufacturers that are in the industry. And one standard based upon one particular level of performance does not necessarily yield information that would be accurate if—I'll put it in quotes—"the best" technological equipment was used.

So I believe that a demonstration effort that could also yield some true performance standards would be advantageous in promoting the overall use of natural gas, not only to the individual consumer, but to the large fleet user as well.

Mr. McCandless. Do you want to add anything?

Mr. Kramer. I'm sorry?

Mr. McCandless. Did you want to add anything to that?

Mr. Hathaway. I guess I feel that the additional testing-type programs, as I said a little earlier, the emissions testing, and so forth, is of marginal value. What I would like to see the programs aim at would be the development of more efficient, more—less costly is really what I'm after—vehicle systems and refueling systems, and to emphasize the dissemination of information that is already available, to emphasize really the education of fleet users, of the public generally. I think fleet users have to be first because they're the most logical place to begin expanding the use of methane. So I'd like to see the direction go that way rather than just some rehashing of additional testing that's already been done.

Dr. Mulvin. Mr. McCandless, I don't want to disrupt the protocol, but——

The Reporter. Excuse me. I can't get this on the record unless he comes over here.

Mr. McCandless. Yes. Why don't we get you back in a little bit here because we do have a system and, as you know, a system is a system is a system. [Laughter.]

I'm going to give you the $64 question now. Back in 1979 when diesels first became a part of the passenger-car powerplants, there was in the neighborhood of a 59-cent differential between diesel fuel and low-lead in cost—a tremendous inducement to pay an additional $750 or $1,000 for a diesel powerplant even though it may have some performance characteristics that were not comparable to gasoline, but that over a 50,000, or whatever, mile range the cost of the fuel would far outweigh the additional cost.

We now have diesel fuel selling for virtually equal to low lead. Obviously, because of the cracking process, you get more out of a barrel of crude of diesel fuel than you do anything else because of its characteristics. Yet, the merchandising of it is such that what has happened is the bloom has gone off of the diesel because there's no longer a real savings in cost versus initial investment.

This theoretical thing I'm going to throw at you—it's theoretical, I admit. We get ourselves all cranked up and we have methane cars running all over, and, all of a sudden, the price of methane begins to creep up, and we find that in the final analysis there is very little in the way of fuel savings. And, as a result, you find us a replay of the diesel scenario that I painted to you.

That's a terrible question to ask two people who are in the gas, natural gas, business, but what's to prevent that from happening?

Mr. Hathaway. You're addressing that to me, sir?

Mr. McCandless. To either one of you, if you wish to answer. If you want to take the Fifth, I'd understand. [Laughter.]

Mr. **Hathaway**. No, I'll attempt to answer it.

I think it's entirely possible that the costs of different fuels are going to come up fairly close, and I guess that's why I emphasize, in suggesting the programs to be done by this amendment or in the private sector, probably more preferably, be directed toward decreasing the cost of conversion or toward developing a vehicle or a series of vehicles that are adapted to natural gas.

I very strongly believe that there does not have to be any essential cost differential between the gasoline and either compressed gas or an LNG vehicle or, if a differential, not very big.

Certainly the engine technology is virtually identical to a typical gasoline engine. The only difference is in the carburetion insofar as the engine is concerned, and the type of carburetor that serves natural gas to an engine is much simpler and even less costly than a gasoline carburetor.

The major difference lies in the fuel storage system, with LNG being more expensive because it's a cyrogenic technology with expensive materials required.

We're making some strides on the CNG side. I note that Alcoa has a program now to develop a lower cost aluminum, lighter weight CNG storage vessel.

So, given the impetus, I think that you can bring the vehicle cost down to what I hope would be almost an equal level with traditional gasoline or diesel fuels.

I like diesels. I've got—I've had two of them. I had a lot of bugs with the first one and not so much with the second one. As time went on, they've gotten better.

The diesel cycle is inherently more efficient than the gasoline cycle insofar as the fuel use goes, and the diesel cycle can be adapted for methane as well. We did some early experiments in that that I forgot to mention, in the sixties, and found out that you could not run a diesel engine purely on methane, but if you put about 5 percent in it to ignite it, it ran just fine. We thought we were pioneers in that, too, until we found out that Mercedes Benz had done the same experiment in 1930. [Laughter.]

Mr. **McCandless**. I'd like to address this question to both of you. The Department of Energy is the focal point, the hub upon which this wheel rotates that we're talking about. Has the Department of Energy been disseminating information to fleet operators and technical information about the feasibility? Are they seeking out opinions? Are they asking advice and technical assistance from those of you who have been involved in this? Are we getting a flow of information here that would be beneficial to the total program that we're talking about on a nationwide basis, where the people who have been out in the trenches have the experience, but is that experience being disseminated through the channels that should be available for it, in your opinion?

Mr. **Kramer**. I'd have to say, in my opinion, the answer to that is basically no. The information is available, but as far as an active dissemination of that information, an active seeking out of opinion, of technical advice, doesn't seem to be happening that much, at least not to our experience.

Mr. HATHAWAY. I would answer the same way. There has not been an active push to disseminate what information the DOE has on methane vehicles.

Mr. McCANDLESS. Well, this—if we're going to move in this direction and try to accomplish the objectives of this demonstration mode, then that information is going to have to be a key part of it. Otherwise, we find out what you found out—that Mercedes did it in 1930.

Mr. HATHAWAY. That's right.

Mr. McCANDLESS. And so we have somebody doing something in Pennsylvania and somebody doing something in San Diego and no communication.

That's very interesting. I appreciate that.

Why don't we keep you up here for just a minute, unless you're in a hurry, and, for the record, we have an interest in reappearing to share with us our good friend from Pennsylvania, Dr. Mulvin.

Why don't you come up to the microphone that is left there, Dr. Mulvin, and you had some thoughts you wanted to share with us. We'll shoot you down or build you up, or however you want to go.

Dr. MULVIN. Well, I only have one thought. That thought is certainly as a grassroot American I think that most of us have some concerns out there that we hold pretty precious, and one of those concerns that we all worry about is perhaps world powers are going to vaporize one another. The other concern is that—it's concern over the possibility that a major Middle East crisis or a further crisis in Central America will, indeed, by virtue of disruption of flow of oil into this country, disrupt our good life.

We saw a minor disruption of that in the middle seventies with the gaslines, and so on, and we didn't like it.

And if there was no other reason—and we've heard a lot of good ones, I think, today—for support for Congressman Glickman's amendment, if for no other reason, I think that we would hope that the Congress would be pursuing other alternatives that could be readily put in place so that all of us in America, with maybe a very minor transition period, could enjoy all that good life that we're so accustomed to.

I'd just like to believe that that thrust is there.

Mr. McCANDLESS. Well, I appreciate your thoughts.

Mr. Hathaway, Mr. Kramer, do you have anything else you'd like to add at this point?

[No response.]

Mr. McCANDLESS. Let me retort you because we're being philosophical here.

One of the problems that I see with the natural gas or methane program is the movement of—the inertia necessary to get a program underway and the total difference in the mode of the operation of the vehicle as it relates to refueling and these various and sundry other things.

And I take the time of the group to go into this because I think that if we're going to talk about something in the way of immediacy that we need to take what we have in the way of resources currently and adapt that to other than a petroleum-based fuel. So when you pull into the station, you're using the same pump; you're using the same station; you're using the same meter; you use the same truck to bring the fuel to the station. And so I would agree with you completely that we need to get off of the petroleum kick as quickly as possible, but I think the immediacy of it is so important that we need to concentrate on ethanol and methanol, because we can utilize our infrastructure, as mentioned before, on an immediacy basis, and all you have to do is take a commodity, a multitude of commodities, and distill them and you've got what you need. That's simply a matter of building that kind of a structure to do so. Everything else is in place.

Now the natural gas and methane people wouldn't—possibly not like me to be talking like that, but we are talking about the dependency of the United States on foreign oil, and your point is well taken.

Thank you for your contribution.

Thank you, gentlemen.

If we have nothing else for the good of the cause, then this subcommittee hearing is adjourned. Thank you.

[Whereupon, at 12:14 p.m., the subcommittee recessed, to reconvene at the call of the Chair.]

APPENDIX

PROPOSED GLICKMAN AMENDMENT 1

DEMONSTRATIONS WITH RESPECT TO METHANE-FUELED VEHICLE EMISSIONS AND METHANE REFUELING FACILITIES

SEC. ___. (a) The Secretary of Energy (hereinafter referred to as the ''Secretary''), in accordance with this section, shall assist and support demonstrations designed to gather data on the operation and emissions of methane-fueled vehicles under differing climatic, atmospheric, and operating conditions, on methane transmission, storage, and dispensing facilities, and on the design and technical modifications of those vehicles and facilities.

(b) Not later than April 1, 1985, the Secretary shall have promulgated necessary and appropriate guidelines for demonstrations under this section, and shall have issued an initial request for proposals for assistance to support public and private entities in developing and implementing such demonstrations.

(c) The demonstrations assisted under this section shall include and be limited to--

(1) ten demonstrations which are designed to develop information with respect to the emissions of vehicles fueled by methane or with dual fuel capacity, and with respect to the design or modification of such vehicles to improve such emissions; and

(2) one demonstration which is designed to develop information with respect to the transmission, storage, and dispensing of methane for vehicles of the type described in paragraph (1), and which shall consist

either of a single refueling station to be available to private and public organizations interested in using such vehicles or of additional pumps at existing facilities.

(d)(1) In providing for such demonstrations, the Secretary is authorized--

(A) to provide technical assistance to the participating public and private entities to the extent that such assistance is reasonably associated with the purposes of the demonstrations involved or will aid in compliance with the data acquisition and reporting requirements imposed under this section;

(B) to make grants to the entities participating in the demonstrations described in subsection (c)(1) to cover the reasonable and necessary costs associated with such demonstrations; and

(C) to make grants to the public entities participating in the demonstration described in subsection (c)(2), and loans to the private entities participating in such demonstration, to cover up to 50 percent of the reasonable and necessary costs associated with the installation of the methane transmission, storage, and dispensing facilities involved.

(2) The Secretary may require recipients of assistance under this section to enter into cooperative agreements with

other recipients of such assistance for the planning and use of the facilities developed in the demonstration described in subsection (c)(2), under a cost-sharing agreement where appropriate and economical.

(3) Loans made to private entities under paragraph (1)(C) shall bear interest at such rate as the Secretary may determine, giving consideration to the needs and capacities of the recipients and the prevailing rates of interest (public and private), except that such rate shall not be less than a rate determined by the Secretary of the Treasury, taking into consideration the current average yield on outstanding marketable obligations of the United States with remaining periods of maturity comparable to the average maturities of such loans. No such loan shall be made unless the Secretary shall have determined that there is reasonable prospect of repayment.

(4) The terms and conditions of loans made to private entities under paragraph (1)(C) shall take into account the scope of the demonstration involved and any particular conditions which might reasonably be expected to result in additional costs to the recipients, and shall reflect the relative costs of gasoline and diesel fuel and methane and the projected savings in fuel costs to the recipients as a result of participating in the demonstration. In no instance shall any such loan be for a period in excess of five years.

(5) The Secretary shall impose (as a condition of assistance under this section) such data acquisition and reporting requirements as may be necessary or appropriate to carry out the purpose of this section, and shall provide for appropriate assistance to defray costs associated with complying with such requirements.

(6) In the case of a participating organization which is comprised of both public and private entities, a package of technical and financial assistance shall be designed, to the maximum extent feasible, in such a manner as to assist both its public and private components as provided for in paragraph (1).

(e) In the case of any demonstration which is initiated as described in subsection (c)(1) after the first fiscal year in which demonstrations described in such subsection are funded, the Secretary shall ascertain that plans for such demonstration take into consideration information and findings included in reports filed on other demonstrations so described which are assisted under this section.

(f) Each demonstration under this section shall have a duration of not more than 3 years, during which time records on emissions data and the use of methane by methane-fueled vehicles shall be maintained and made available to the Secretary in accordance with guidelines promulgated by the Secretary prior to the issuance of the first loan or grant under this section, and shall be amended no more often than twice annually.

(g) In selecting proposed demonstrations to be supported under this section the Secretary shall, to the maximum extent practicable, assure representation of diverse operating conditions and vehicle types, including but not limited to--

(1) altitude and topography,

(2) climatic conditions,

(3) air quality conditions,

(4) industrial, commercial, and agricultural uses,

(5) varying vehicular structures, and

(6) average trip lengths.

At least two of the demonstrations described in subsection (c)(1) shall be located in counties or standard metropolitan statistical areas designated by the Secretary upon recommendation of the Administrator of the Environmental Protection Agency based on the severity or uniqueness of air quality conditions.

(h) There are authorized to be appropriated to the Secretary for the fiscal years 1985, 1986, and 1987 (in addition to any amounts authorized to be appropriated for such fiscal years by the preceding provisions of this Act) such sums as may be necessary to carry out this section.

PROPOSED GLICKMAN COMPROMISE AMENDMENT 2

Amendment to H.R. 5244, as reported
Offered by Mr. Glickman

Page 26, after line 12, add the following new section:

Sec. 303. (a) In furtherance of the goals of the Methane Transportation Research, Development and Demonstration Act of 1980 (15 U.S.C. 3806), the Secretary of Energy (hereinafter referred to as the "Secretary"), in accordance with this section, shall conduct demonstration activities designed to gather and disseminate data on the operation and emissions of methane-fueled vehicles under differing climatic, atmospheric, and operating conditions, on methane transmission, storage, and dispensing facilities, and on the design of and technical modifications to those vehicles and facilities.

(b) Not later than April 1, 1985, the Secretary shall have promulgated guidelines for activities under this section and shall have issued a solicitation for participation by fleet operators in such activities.

(c) The data-gathering activities to be conducted under this section shall include and be limited to --

(1) collection of operating data over a two-year period --

(A) from three existing private sector fleets and one government fleet, each with approximately 25 methane-fueled vehicles, and

(B) from a corresponding number of gasoline-powered fleet vehicles to provide a comparison of their operating costs, maintenance history, and performance characteristics, with the corresponding costs, history, and characteristics of the vehicles described in subparagraph (A);

(2) laboratory emissions testing of five representative methane-fueled vehicles from each of the participating fleets described in paragraph (1)(A), to be performed periodically during the two-year data collection period;

(3) collection of data with respect to the operation, maintenance, and cost of the refueling facilities used by each of the four participating fleets described in paragraph (1)(A) during the two-year data collection period; and

(4) publication and dissemination of summary data, results, and findings from all data-gathering activities.

(d) In conducting such data-gathering activities, the Secretary is authorized to reimburse fleet operators participating under paragraph (1)(A) for the reasonable costs incurred by them in connection with such activities, including the acquisition of temporary substitute vehicles for use during emissions testing of the methane-fueled vehicles.

(e) There are authorized to be appropriated to the

Secretary for the fiscal years 1985, 1986, and 1987 (in addition to any amounts authorized to be appropriated for such fiscal years by the preceding provisions of this Act) such sums as may be necessary to carry out this section.